A McGRAW-HILL ELECTRONICS PUBLICATION

FEBRUARY 18, 1985

ElectronicsWeek

THE MAGAZINE OF THE WORLDWIDE ELECTRONICS INDUSTRY

ROBOTS COME TO THEIR SENSES

2 9 APR RECD

USERS STRESS SIMPLICITY
PAGE 22

Phase-conjugate optics transports lasers into twilight zone/34

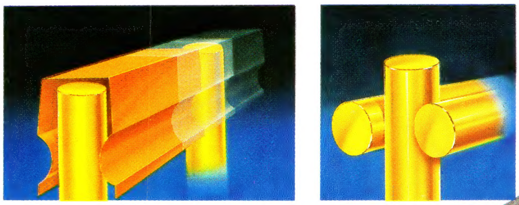
What's ahead for the consumer electronics industry/61

NKK ANNOUNCES THE WORLD'S MOST RELIABLE LOGIC-LEVEL SWITCH CONTACT MECHANISM.

Entire Sliding Twin Crossbar system gold-plated.

Logic-level switch reliability has taken a quantum leap forward with the introduction of NKK's patented, award-winning Sliding Twin Crossbar contact mechanism.

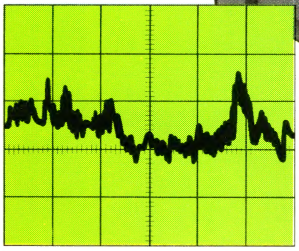
The new gold-plated design utilizes a self-renewing action that literally wipes the switch's contacts clean with each actuation. Furthermore, after the contact area is cleansed by the sliding motion, the contact surface is "pinched" by the cylindrically shaped sides of the movable contactor. The effect is that of twin crossbars gliding into position to make contact. The result is highly stabilized, highly concentrated contact which creates increased reliability at logic-level.



GOLD-PLATED SLIDING TWIN CROSSBAR CONTACT PRODUCES SMOOTHER OPERATING ACTION AS WELL AS UNMATCHED RELIABILITY.

In addition, the unique Sliding Twin Crossbar system provides a back-up, or failsafe, path for current. If one side or "bar" of the movable actuator should fail to conduct, the other is there to make contact.

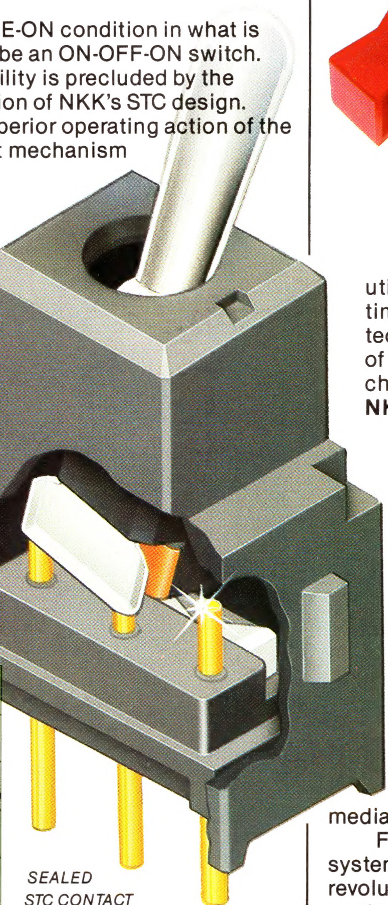
STC improves "feel" of actuation as well as reliability.



Until now, design engineers have found it difficult to create smooth operating, highly reliable switches within the framework of sliding contact technology. However, by utilizing "round" stationary and common contact points (U.S. Patent No. 4371767), NKK's STC produces an exceptionally smooth operating feel. In fact, traditional non-STC contact mechanisms can cause an ON-NONE-ON condition in what is suppose to be an ON-OFF-ON switch. This possibility is precluded by the sophistication of NKK's STC design.

The superior operating action of the STC contact mechanism becomes obvious when an NKK switch is compared to competitive types.

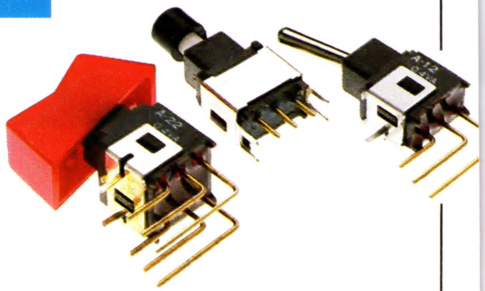
SLIDING TWIN CROSSBAR



SEALED STC CONTACT ALLOWS TIME-SAVING WAVE SOLDERING AND SAFE WASHING.

STC switches completely washable.

While the contact area of NKK's STC mechanism is cleaned with each wiping action, the rugged sealed-body construction of the switch adds an extra measure of protection against contamination, oxidation and sulfurization. As a result, NKK devices utilizing STC may be subjected to time-and-cost-saving wave-soldering techniques, then washed without fear of compromising their operating characteristics.



NKK STC-actuated toggles, rockers, pushbuttons and slide switches available for immediate shipment.

Choose from single- or double-pole STC switches in a full range of momentary or maintained circuits with ratings of .4VA Max. @ 28V Max. (applicable range: 20 mV ~ 28V/0.1mA ~ 0.1A). Right-angle, verticle and straight-mounting bracketed or unbracketed terminations are available. Some switches are offered with anti-static bushings. All conform to standard .100 x .100 PC board grid patterns. All are available for immediate shipment exclusively from NKK.

For more information about the STC system and the switches which have revolutionized logic-level reliability, contact NKK: 602/991-0942. TWX 910-950-1167.

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nkk switches

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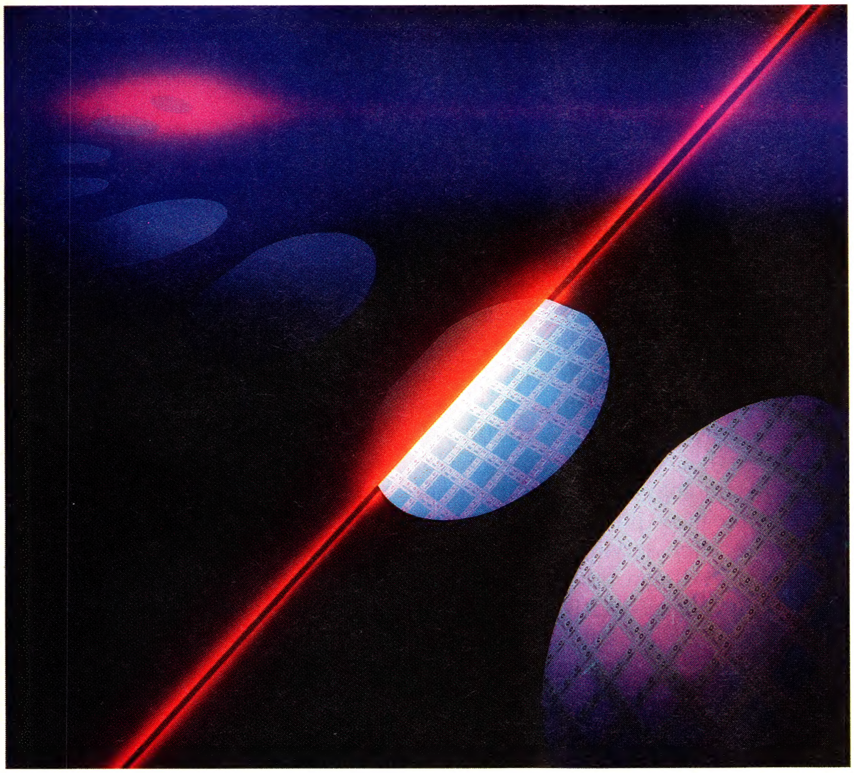
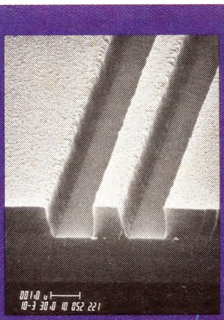
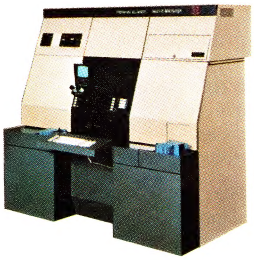
The new Micralign® 660 HT: 100 6-inch wafers/hour plus automatic setup and monitoring.





This SEM prepared on the Micralign 660 HT shows 1.25 μm wide lines and spaces (Aperture 1, UV-4 spectral range).



The Micralign 660 HT projection mask aligner gives you six-inch wafer handling with the highest throughput in the industry. The result—a lower cost per shippable VLSI die.

As an added benefit, you also get Perkin-Elmer's new Automatic Setup and Monitoring system (ASM). This advanced system provides your operators with a menu-driven display that allows down-loading of pre-established process files.

Operator-machine interaction is faster and easier than ever before. Setup time is dramatically shortened. And the opportunity for error sharply reduced.

Incorporating the same field-proven optical system and automation features that have made the Micralign 500 series so productive, the 660 HT provides Automatic Magnification Compensation and Automatic Fine Alignment.

The 660 HT also maintains the impressive machine-to-machine overlay accuracy of ± 0.45 μm with resolution capability from 0.9 μm to 1.25 μm.

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International edition

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PUBLISHER: Laurence Altman

Altman named publisher of ElectronicsWeek

In its 55-year history, this magazine has seen all its publishers come up through the ranks of the business side. Never has it had one who started as an editor. Now, with the appointment of Laurence Altman as senior vice president and publisher, that tradition is broken.

Altman, who has a bachelor's degree in physics from Cornell University as well as graduate degrees in physics from Lehigh University and Columbia University, joined *Electronics* as an associate editor, then became a senior editor and managing editor. He earned high marks throughout the industry for his coverage and interpretation of developments in the hectic early days of the semiconductor industry, when technology advanced rapidly and Silicon Valley seemed to spawn a startup every time two designers got together for lunch. And it was Altman who first wrote about the potential of a then-infant technology known as integrated injection logic.

For the new publisher, it is actually a return to McGraw-Hill and the magazine after serving for the past five years as publisher of *Electronic Design.* As Altman puts it, "I am returning because I relish the opportunity and the challenge and because the reputation that *ElectronicsWeek* has built up in its 55 years is unmatched in the industry."

Next ElectronicsWeek

The Pentagon pushes for Josephson junction research

IBM Corp.'s decision to drop its effort to develop a superconductive mainframe computer, leaving the U.S. without a facility to build Josephson junction chips with higher levels of integration, is giving the Defense Department a case of the jitters. The reason is that Japan has several such facilities. Now a task force has recommended the establishment of a research center to be available to all U.S. researchers. What chance does the proposal have? The answer is in next week's issue of *ElectronicsWeek.*

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ElectronicsWeek

THE VOICE OF THE INDUSTRY, HEARD EVERY MONDAY

CONSUMER ELECTRONICS
Brash high-technology marketing/61

Technology Around the World

Telecommunications GSA seeks fast phone net. The General Services Administration is proposing what would be the largest telecommunications contract ever let to revamp the government's voice/data network **17**

- EC strives for telecom standards. While the U.S is talking contracts, the Commission of European Communities is still trying to sort out standards problems for broadband networks. Progress is seen, however **18**

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- Robots come to their senses. Newcomers to the robotics arena don't realize how much intelligence is required for even the simplest forms of object recognition and limb coordination **22**

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WOW!

Dual Channel Power Measurements to 50 GHz AND –50dBm!

Boonton has combined with Hughes Aircraft to extend the sensitivity and convenience of the Boonton 4200 dual-channel power meter to the accurate measurement of millimeter-wave signals. Three new waveguide sensors, each with 60 dB dynamic range, operate in K-band (18 to 26.5 GHz), Ka (26.5 to 40 GHz), and Q (33 to 50 GHz). Based on Hughes' "whisker-contacted", SEM-assembled, millimeter-wave diode technology, these sensors feature a maximum SWR of less than 1.3 for low measurement uncertainty. Computer-generated cal factors are provided in 1 GHz steps. Nine coaxial sensors are also available with a choice of 50Ω or 75Ω inputs, high sensitivity diode or true RMS thermocouple detection, and with a dynamic range of up to 70 dB to cover levels from –60 dBm to +30 dBm, 100 kHz to 18 GHz.

The 4200 can store complete calibration data for up to 8 sensors in nonvolatile RAM for quick interchangeability. Stored cal factors are accessible for automatic interpolated measurement corrections as a function of frequency. Fast settling times and a user-defined "raw data mode" speed measurement times with GPIB. Features of the 4200 include display in dB or watts, single or independent dual channel operation, instantaneous display of the difference of two channels, selectable dB limits, dc output, and self-calibration to an internal NBS — traceable reference.

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VOLUME 58, NO. 7 FEBRUARY 18, 1985

ElectronicsWeek

Microwave CAD CAE/CAD bests another beast. Manufacturers will soon expand their microwave CAE work-station arsenals to include a host of software-based computer-aided design functions **38**

People For Olivetti's Paolo Viti, design is more than skin deep. Jon A. Shroyer, RCA's man at Sharp. Shepard Siegel has vision **54**

Companies Force Computers' innovative startup. Medicomp is smiling **58**

Special Technology Reports

Consumer Electronics Consumer gamble. Manufacturers are betting high stakes on consumer products, such as the newest flat-panel TVs, that have shown less than spectacular sales but still have a high interest level among consumers **61**

Computers Locking up system security. Unauthorized access to a computer system may be the fastest-growing crime in the world. Now, semiconductor technology and encryption algorithms team up in a hardware implementation to thwart would-be criminals **68**

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Video VME design improves image. Video-acquisition, frame-storage, and display systems fit on a single VME board. **77**

Data Converters ADCs are accurate to 1.5-microsecond conversion time **85**

Software Software performs, displays Fourier transforms **90**

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Meetings

IPC 28th Meeting, Institute for Interconnecting and Packaging Electronic Circuits (3451 Church St., Evanston, Ill. 60203), Sheraton, New Orleans, March 30-April 4.

14th International Programmable Controllers Conference, Engineering Society of Detroit (100 Farnsworth Ave., Detroit, Mich. 48202), Cobo Hall, Detroit, April 2-4.

Unix Systems Exposition, Networks Events Ltd. (Printers Mews, Market Hill, Buckingham, MK181JX, UK), Palais des Congres, Paris, April 2-4.

Fiber Optic Market & Technology Trends for the '80s, Information Gatekeepers Inc. (214 Harvard Ave., Boston, Mass. 02134), Logan Airport Hilton, Boston, April 9-10.

1985 CIM Industry Days, U.S. Air Force (Faye Geidner, 1616 Mardon Dr., Dayton, Ohio 45432), Loews Anatole, Dallas, April 9-12.

Memory Card Technology, Battelle Memorial Institute (Phil Wells, 505 King Ave., Columbus, Ohio 43201-2693), Battelle's Columbus Laboratories, Columbus, April 10-11.

Tri-State Telecommunications Exhibition, Telecommunications Management Association (Thomas W. Shea, Shea Management Inc., 1326 Freeport Rd., Pittsburgh, Pa. 15238), Civic Arena, Pittsburgh, April 10-12.

Local Area Network Market & Technology Trends for the '80s, Information Gatekeepers (214 Harvard Ave., Boston, Mass. 02134), Logan Airport Hilton, Boston, April 11-12.

63rd Convention & International Exposition, National Association of Broadcasters (1771 N St. N.W., Washington, D.C. 20036), Convention Center, Las Vegas, April 14-17.

Telecommunications Under Deregulation, Telecommunications Conference Center (Carol A. Hertzoff, The Energy Bureau, 41 E. 42nd St., New York, N.Y. 10017), Sheraton, Arlington, Va., April 15-16.

Conference on Software Tools, Center for Advanced Telecommunications Technology of the Polytechnic Institute of New York (George E. Estes, AT&T Network Systems, 6 Corporate Place, Room 1E261, Piscataway, N.J. 08854), Sheraton Centre, New York, April 15-17.

Materials Research Society Spring Meeting (John B. Ballance, 9800 McKnight Rd., Pittsburgh, Pa. 15237), Golden Gateway Holiday Inn, San Francisco, April 15-18.

Cimcom '85, Society of Manufacturing Engineers (1 SME Dr., Dearborn, Mich. 48121), Disneyland Hotel, Anaheim, Calif., April 16-18.

Medical Imaging & Instrumentation '85, Society of Photographic Scientists and Engineers and the International Society for Optical Engineering (SPSE, 7003 Kilworth La., Springfield, Va. 22151), Back Bay Hilton, Boston, April 21-23.

Speech Tech '85 Voice Input/Output Applications Show, Media Dimensions Inc. (Stanley Goldstein, Media Dimensions Inc., P.O. Box 1121, Gracie Station, New York, N.Y. 10028), Vista International Hotel, New York, April 22-24.

33rd National Relay Conference, National Association of Relay Manufacturers (Dan Lingelbach, 202 ES, Oklahoma State University, Stillwater, Okla. 74078), Oklahoma State University, Stillwater, April 22-24.

Electro/'85, IEEE (Electronic Conventions Management, 8110 Airport Blvd., Los Angeles, Calif. 90045), New York Coliseum, New York, April 23-25.

Seminar

Database-Management Systems & Fourth-Generation Languages for Personal Computers, Software Institute of America Inc. (8 Windsor St., Andover, Mass. 01810), Denver Airport Hilton, Denver, March 27-29; The Ritz-Carlton Buckhead, Atlanta, April 17-19.

12 Weeks
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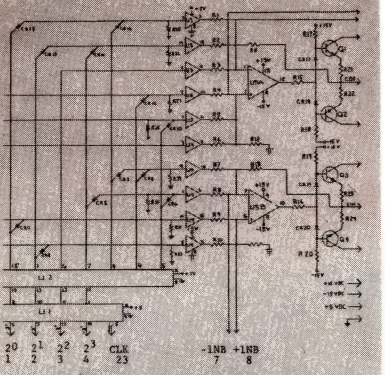

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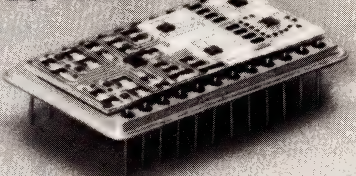

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Xebec's New Owl Redu
Storage To

Then.

Microcomputer storage history has progressed by a series of small "next logical steps." A replacement of a component here, a refinement of technology there. But now Xebec has taken a giant step, with its Owl intelligent disk file.

On the surface, the Owl might look like other 10-megabyte, 5¼" half-high Winchesters. Underneath, however, it's an example of superior technology. The integration of controller logic and drive electronics on a single board means not just one less PCB, but the elimination of expensive connectors and cabling, low power consumption (15 watts typical) and enhanced data integrity.

Single-board drive and controller electronics insure higher reliability

Integrated data separation within disk drive delivers higher data integrity

Ruggedized design includes head landing zone

Comprehensive diagnostics eliminate "What's wrong?" guesswork

Compatible with industry-standard Xebec SASI bus for faster system integration

We've put data separation in the HDA for precise control of data windowing and the elimination of background noise. We've provided a diagnostics channel to the host that delivers meaningful error messages.

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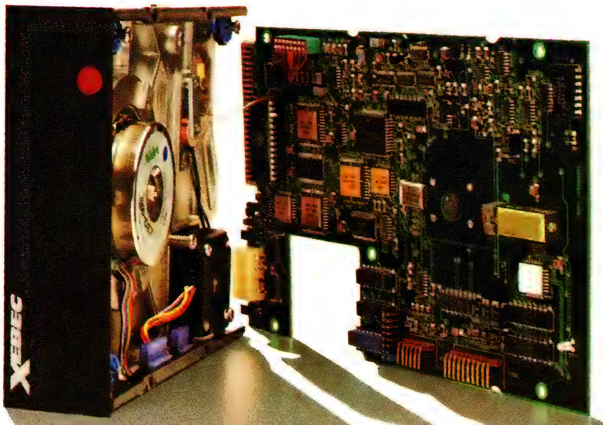

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REACTIONS MIXED OVER IBM'S SIERRA

Moving to strengthen its already formidable grip on the mainframe computer market, IBM Corp. last week introduced its new 3090 high-end processor, which had been code-named Sierra. Although the enhancements incorporated into Sierra and the current series of 308X mainframes appear to represent a steady progression in the IBM mainframe product line, industry analysts expressed disappointment with the disclosure, particularly because one model won't be available until 1987. The 3090 family brought out by IBM includes the entry-level model 200, priced at $5 million and available in November, and the model 400, available in the second quarter of 1987. The 3090/400 will be available only as a field upgrade to the 3090/200 and will cost an extra $4.3 million. The 3090/200 contains two central processors in a dyadic configuration that offers 1.7 to 1.9 times the internal throughput rate of IBM's 3081KX mainframe in a commercial environment and 1.9 to 2.9 times for scientific and engineering applications, IBM officials say. IBM's original 3081 mainframe performs 10 million instructions per second; the 200 operates at an estimated 23 to 32 mips for general-purpose applications and 32 to 49 mips in the scientific and engineering environment. The 3090/400 upgrade is a four-way processor with 1.7 to 1.9 times the instruction-execution rate of the 200. It could operate at 39 to 61 mips for business applications and 54 to 93 mips for engineering applications, thereby approaching supercomputer capabilities.

For engineers, "you just struck gold," says Charles Greco, who follows the mainframe market for International Data Corp. But "for the general-purpose user who has to get the payroll out the door, he's still wondering what he's going to do." Characterizing the IBM announcement as too little, too late, Greco argues that the 200 provides no more raw horsepower for general-purpose use—about 30 mips, he estimates—than IBM's current top-of-the-line mainframe, the 3084QX. Greco predicts that Japanese mainframe competitors such as Hitachi, Fujitsu, and NEC, in partnership with U.S. mainframe suppliers, may also introduce products by 1987 that are equivalent to the 3090/400. "We were very disappointed by this announcement," he emphasizes. Other analysts were less critical, saying the introduction was about what they expected. IBM's mainframe market share, according to IDC, is 76% when IBM-compatibles are included and 65% when they are not. For this reason, concludes Harry Edelson of Edelson Technology Partners, "It wasn't a real requirement for IBM to juice things up that much."

Perhaps the most innovative aspect of the Sierra introduction was the new circuit and packaging technology it incorporates. Company officials say Sierra is the first implementation of IBM's 288-K memory chip, now in volume production at manufacturing facilities in Essex Junction, Vt., and West Germany. The 200 has 64 megabytes of memory; the 400 has 128 megabytes, expandable to 192 megabytes. The 3090 also contains enhancements to the thermal-conduction-module packaging technology of the 308X family, most notably the replacement of TTL chips with faster emitter-coupled-logic chip technology. Although IBM officials were tight-lipped about the higher-speed ECL technology, ECL chips generate perhaps up to twice as much heat, a computational byproduct that is dissipated by the thermal conduction modules. Despite these innovations, Amdahl Corp., which ranks third in mainframe shipments behind IBM and Burroughs Corp., probably won't have trouble matching Sierra in mips, or price, says William Easterbrook, a research analyst at Kidder Peabody Inc. Furthermore, "I don't think the price will worry [Amdahl] at all." Echoing Easterbrook, an Amdahl spokesman adds that "Amdahl does not think that the 3090 pricing was very aggressive. Amdahl's 580 series product line still remains competitive with IBM's high end." The IBM-compatible mainframe maker is currently working on a new machine that the spokesman claims will surpass the 400. It will be announced in 1986, he says, in time to compete with the 400. ☐

Book-to-bill rate gains slightly as bookings slip . . .

With chip bookings in January nearly flat from the December level, the semiconductor industry's bellwether book-to-bill ratio posted a slight upturn last month, reaching 0.66:1 from the prior month's 0.58:1, according to the Semiconductor Industry Association. U.S. semiconductor billings for January were $728.1 million, off 31.1% from December, notes the SIA's monthly report. Based on these figures, the SIA now predicts first-quarter shipments of $2.4 billion, down 20% from the fourth quarter of 1984. The SIA is now predicting that 1985 billings will be flat compared with the $11.6 billion estimated for 1984. SIA president Thomas D. Hinkelman said that an upturn in bookings is not expected until late in the second quarter. ☐

. . . while U.S. and Japan agree to end chip duties March 1

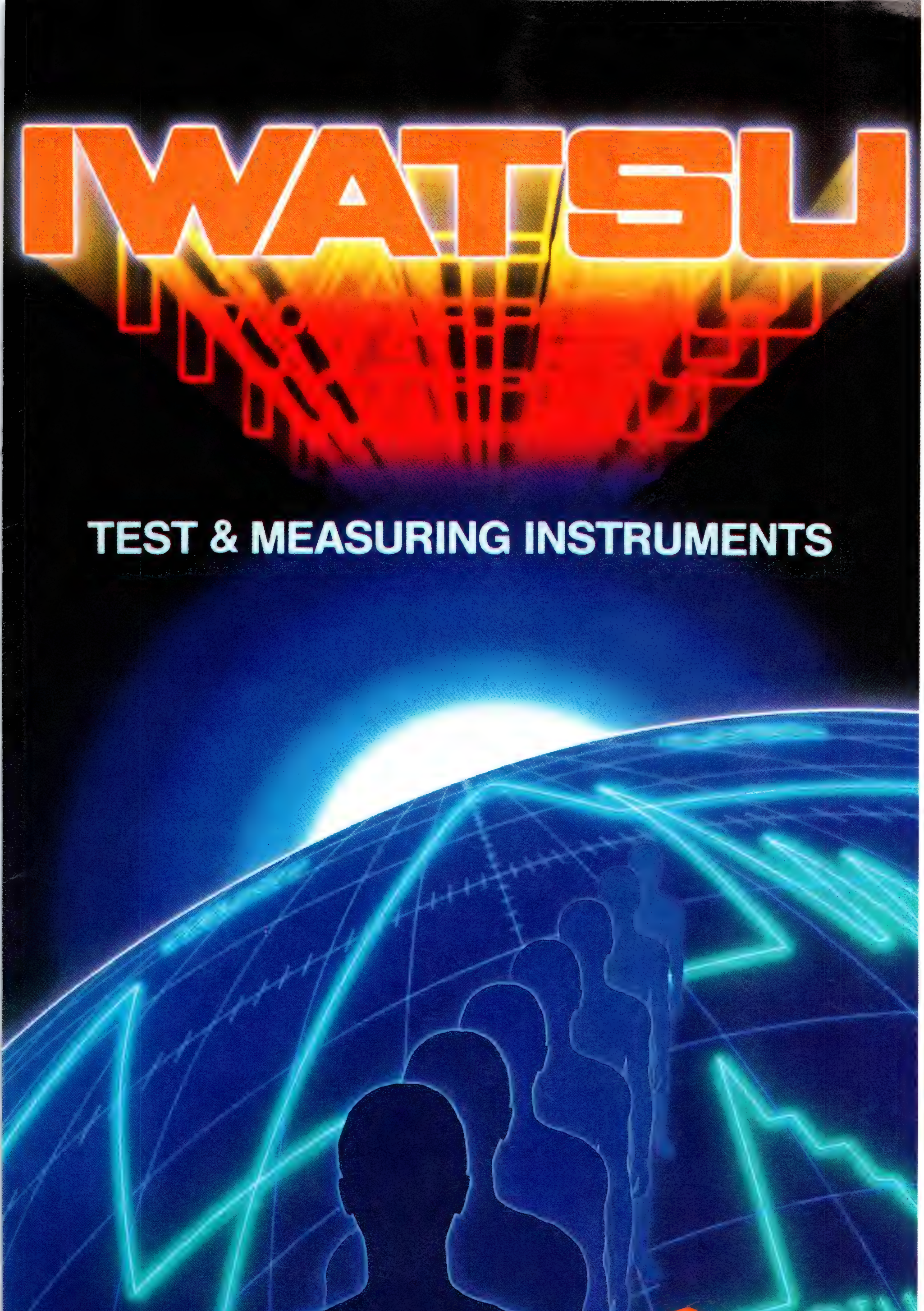
Meanwhile, the U.S. and Japan formally agreed to eliminate all duties on semiconductor trade between the two countries as of March 1. The move has been in the works since a recommendation by a joint high-technology work group in November 1983. "There is still much work to do, however, before we will have a fully open trade relationship with Japan," notes SIA president Thomas D. Hinkelman. An SIA representative explained that he was referring to a "buy Japanese" philosophy that persists in Japan despite high-level expressions of support for free trade. ☐

Grumman in pact with NASA to make semiconductors in space

Grumman Corp. and the National Aeronautics and Space Administration have signed an agreement paving the way for the aerospace firm to conduct materials-processing experiments for semiconductors on board the space shuttle. This agreement "affirms our belief that the low gravity of space offers great potential for manufacturing," says Grumman president George M. Skurla. Making semiconductors in space may eliminate imperfections found in the compounds, he contends. ☐

DEC comes to the end of the Rainbow

Digital Equipment Corp. disclosed last week that it is ceasing production of its Rainbow personal computer. The firm said the plant used to assemble the machines would be converted to manufacture an unannounced new product. Launched three years ago, the Rainbow generated disappointing sales, a company representative noted. However, "Personal computers [remain] a very important and integral part of our overall strategy," he added. Digital says it will continue to sell the Rainbow from inventory. ☐



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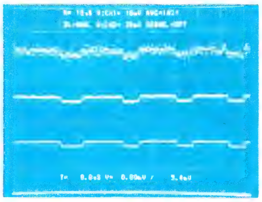

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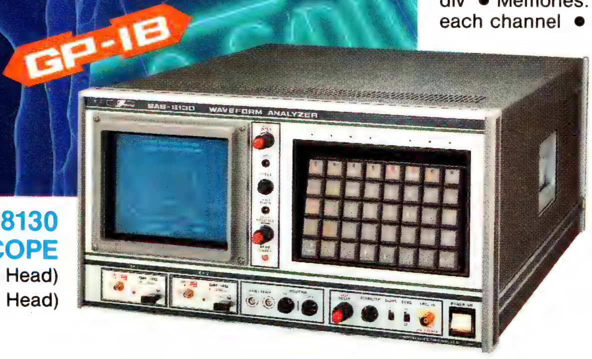

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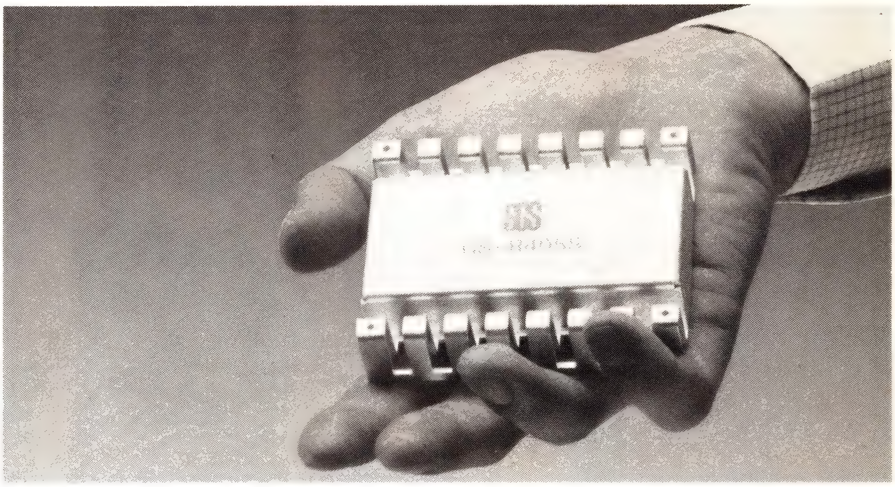

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GS-R405	8-48	5	4	5	0,5	100	60	20	0,2	5	No	6	75	25	75
GS-R405S	8-48	5	4	5	0,5	100	60	20	0,2	5	Yes	6	75	25	75
GS-R412	15-48	12	4	5	0,5	100	60	40	0,5	5	No	15	75	30	85
GS-R415	18-48	15	4	5	0,5	100	60	60	0,6	5	No	18	75	40	90
GS-R424	27-48	24	4	5	0,5	100	60	90	1	5	No	29	75	50	90
GS-R400V	V_0+3-48	5-40 ADJUST.	4	5	0,5	100	60	20/90	0,2/1,6	5	No	1,2V_0	75	25/50	75/90

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Technology and Service

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GSA SEEKS FAST PHONE NET

Procurement agency prepares to let 10-year contract worth $4.5 billion for upgraded telecommunications services

☐ *by Karen Berney*

Washington

The General Services Administration, proposing the largest telecommunications deal in the industry's history, has unveiled a plan to revamp completely the government's long-distance voice/data network, the Federal Telecommunications System. Up for grabs is a 10-year contract expected to generate at least $4.5 billion in cash for the contractor that can sell itself as the government's lowest-cost telecommunications utility.

The scope of the task confronting the lucky winner will be nothing less than awesome, says Bernard J. Bennington, the GSA's director of central information services. As the world's biggest private-line network, the system carries some 1.5 billion call minutes a year to more than 1.3 million users in all 50 states. Almost entirely an AT&T Co. system, the 11-million-mile FTS consists of 52 tandem switches connected by 15,000 trunks, with 44,000 access lines serving more than 1,600 private branch exchanges and Centrex systems.

But the system has two fundamental problems: it is both obsolete and too expensive, explained Bennington in a recent interview. All of the major switches and most of the local ones are analog. The fastest data-transmission speed they offer is 2,400 b/s, "which is no longer suited to our needs," he reports. The kinds of services in demand that the current system cannot supply include electronic and voice mail, full-motion color video, and access to management information in real time.

Furthermore, by the early 1990s, the system will be essentially a data network on which voice is overlaid. While data now accounts for only 15% of its traffic, it is growing at about 20% a year, compared to 5% for voice, he notes.

Because of advances in technology and the rise of competition stemming from the AT&T divestiture, Bennington thinks the GSA can get the system of the future for a lot less than what it now pays. This year, the government will spend more than $450 million on its intercity telephone bill. By switching over to new technologies, the GSA estimates it can drive down costs by at least 20%.

One-stop utility. Unlike past federal telecom procurements, the GSA does not intend to buy, operate, and maintain any hardware or get involved in any of the systems engineering. "What we're looking for is a one-stop utility that will be the prime contractor and provide all management, administration, engineering, billing, and control of the services," he stresses. As a result, the GSA's request for proposals, due to be released in July, will be couched in terms of service specifications, which in turn will become the standard for that service. For example, a service item may be a 9,600-b/s data-transmission rate with a fixed limit on bit-error rates. The bottom line, though, for the GSA, will be what the contractor will charge on a cents-per-call/service-minute basis.

"Basically, then, we don't care what kind of technology is proposed . . . whether it's tin cans connected to wire makes no difference to us, so long as we're convinced that the contractor is delivering the capability at

Tough task. Bringing the government's FTS network up to date will be an awesome task, says the GSA's Bernard J. Bennington.

the lowest cost," remarks Bennington. And there will be every incentive to do so. If a federal agency finds that the contractor's services are not the very best value, it will have the option to take its business elsewhere.

With the new FTS calling for such a broad range of services and technologies, no single company will be able to supply the total package. Even AT&T can't make it alone, although Bennington sees the firm's recent agreement with Electronic Data Systems Corp. as positioning it to bid aggressively on the project.

FTS is both obsolete and too expensive. A switch to new technologies could drive down costs by at least 20%.

But the prime contractor need not be a long-distance-telephone company. Because data will dominate the network, the GSA anticipates hearing from all the big-time computer vendors as well as experienced engineering houses. More than 100 companies turned up at the GSA offices last week for a briefing on the Federal Telecommunications System. Among these were such nontraditional telecom players as Honeywell, Fluor, and Sears, Roebuck.

Teaming up. Whether the industry teams are led by a common carrier, computer company, systems-engineering firm, or hardware manufacturer, all of them are expected to gravitate toward a similar network architecture. Solutions are likely to be based on packetized technology and heavily software defined, agree a number of industry engineers who requested not be identified with their particular companies.

"One has to go with packet switching for three reasons: interoperability, buffering and flow control, and cost," asserted one expert. The need for end-to-end interoperability is also seen as leading toward adoption of integrated services digital network standards. Any contractor who fails to propose a standard interface between the switch and the phone instrument is likely to be at a disadvantage. ☐

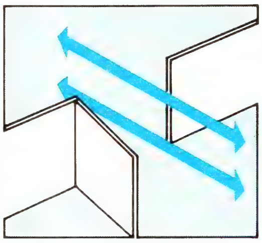
EC STRIVES FOR TELECOM STANDARDS

Brussels

In a last-ditch attempt to create a homogeneous European market for telecommunications equipment and services, the Commission of the European Communities in early February agreed in principle to set up a research and development program aimed at standardizing the next generation of broadband networks.

The program, designated RACE (for Research on Advanced Communication in Europe) could propel the European telecommunications market out of its dead end. Despite repeated efforts to create a competitive environment, Europe remains a group of heterogeneous and protected national markets. And none is large enough to provide native suppliers with a decent return on the substantial investments required.

Sharp focus. Close on the heels of Esprit's debut [*Electronics Week*, Feb. 4, 1985, p. 17], the EC's effort to promote cooperation in data-processing research, RACE is intended to have a narrower focus. While Esprit supports computer and related research in the broadest sense, RACE, in contrast, is geared to produce a product called the Integrated Broadband Communication Network (IBCN).



Should RACE be successful, such networks would be end-to-end compatible in all EC-member countries. Although no budget has as yet been worked up for RACE, some Eurocrats figure the program will match—or even surpass—the $300 million earmarked for Esprit.

Architecturally, the network would serve as a virtual node in networks that provide a panoply of narrowband and broadband services.

In the IBCN, all switching would be digital and all transmission lines fiber optic. On one side, service providers would convey all prospective services using specialized networks, such as a direct broadcast satellite, digital mobile communication, a value-added network, a public-services digital network, and an integrated services digital network. These would interface with the IBCN. On the other side, business and residential users would communicate through private automatic branch exchanges and dedicated home terminals.

Daunting objectives. The overall objectives for the RACE project are daunting. With extensive cooperation among telecommunications authorities, equipment manufacturers, and potential services providers, all narrowband and wideband services for business and residential users are to be available in precompetitive prototype digital systems by 1990. Commercial systems will then follow within five years.

EC officials decline to set a deadline for the approval and implementation of the RACE program, though they and European telecommunications industry executives agree that to have any hope of meeting the deadline being currently considered, organizational work would have to get under way sometime this year.

The highly favorable climate for cooperation in Europe at the moment will help foster the kind of international collaboration that is essential if RACE is to succeed.

For one thing, there is the launch last month of the Esprit computer-technology program, which will put high-technology companies to work in a transnational context. For another, there's a recent accord signed by the EC's four principal producers of digital switches—the UK's Plessey, Italy's Italtel, West Germany's Siemens, and CIT-Alcatel of France. They will work together to standardize interfaces for future generations of exchanges. –**Robert T. Gallagher**

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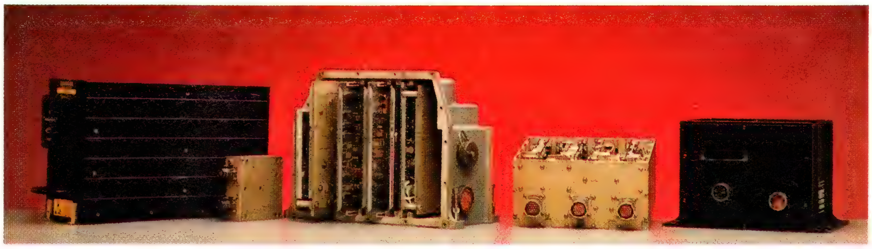

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NEW ENTRIES ESCALATE PBX WAR

Richardson, Texas

In a growing telecommunications battle that is certain to reach nearly every corner of the automated office, Northern Telecom Inc. has launched an extensive line of new integrated voice/data products that it hopes will ring up megabucks in private-branch-exchange markets.

Last week's product unveiling in Laguna Beach, Calif., is expected to fan competitive fires that are already stoked by major PBX suppliers, including AT&T, Rolm, NEC, and Mitel. At stake is an enormous potential market that some market experts say is difficult to estimate.

"It's a giant, giant marketplace," responds John Madrid, president of the Marketing Programs and Services Group. Madrid estimates the U.S. replacement market alone will provide opportunities to sell 100,000 voice/data PBXs in the next four to seven years. "That's not taking into account any growth," Madrid says, adding that markets usually grow 6% to 7% annually. U.S. shipments of PBXs now account for more than 3.5 million lines a year.

Speedy phone-line system. Among the major additions to Northern Telecom's SL digital PBX offering is a new broadband local-area network capable of simultaneous voice and data transmissions up to 2,000 feet. Lanstar runs at 2.56 Mb/s using two twisted pairs of standard phone wires, one pair for each direction of the transmission. Using one phone line, it supports a 512-kb/s rate. The network is made possible by very large-scale integrated circuits that were developed at Northern Telecom's research arm, Bell Northern Research. The proprietary circuits, made from 4-μm CMOS, reside at the user site and inside the switching equipment.

Used both at the terminal as well as on the LAN interface card, the VLSI chip that drives Lanstar contains an adaptive equalizer, phase-lock loop, elastic store, and line drivers and receivers.

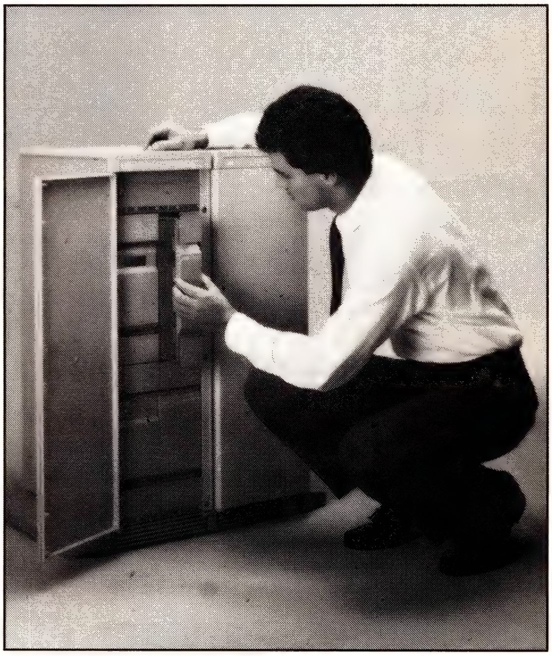
This new network fulfills a two-year-old promise by Northern Telecom to substantially increase the bandwidth of its Open Protocol Enhanced Networks, an effort that has been dubbed the Open World project. The Nashville, Tenn., subsidiary of Canada's Northern Telecom Ltd. has earmarked $1.2 billion over five years to develop the Open World. With the enhanced bandwidth, Northern Telecom plans eventually to add high-resolution graphics and image networking to its voice/data Meridian products, says Dave Brannan, manager of systems engineering at the Integrated Office Systems Division, in Richardson.

Digitized voice. Through Lanstar, Northern Telecom initially will be hooking up IBM Corp. Personal Computers and its new 68010-based Meridian 4020 voice/data terminal to PBX systems. Among the new integrated voice/data services made possible through such a link are the ability to attach digitized voice or data messages to electronic voice or data messages. Another feature allows two users to simultaneously view, discuss, and make changes on a document—all transmitted over the phone-line network.

The Meridian products also include a new voice/data integration add-on cabinet for the SL line of digital PBXs as well as a smaller departmental system that can connect to any brand of PBX or central switching office. Both voice/data cabinets contain 40-Mb/s internal network buses, 16-bit microprocessor-based modules that can execute third-party office-application programs, and the software needed for converting popular voice and computer communications protocols.

The larger Meridian SL hardware has redundant 40-Mb/s buses. This cabinet contains loosely coupled 68010-based application processors, which run applications software under Microsoft Corp.'s Xenix implementation of AT&T Bell Laboratories' Unix operating system. It also features dynamic bandwidth allocation, which automatically gives priority to voice and synchronous data over 30 Mb/s of the system's bandwidth. Meridian SL add-on systems are priced from $80,000 to $1.2 million, and can serve up to 30,000 users. Initial shipments of this unit are planned for the third quarter.

The smaller DV-1 system divides its 40-Mb/s internal bus between digital voice and data. The DV-1 cabinet can contain application processor modules based either on Motorola's 68010, running Unix, or on Intel's 80286, using Concurrent DOS from Digital Research Inc. The system initially can be connected to IBM PCs and Meridian 4020 voice/data terminals from Northern Telecom. A typical entry-level DV-1 system sells for about $40,000. A fully loaded system can support up to 35 data users and 100 voice users concurrently.



Accommodating. Northern Telecom's DV-1 cabinet can host processor modules based on Motorola's 68010 under Unix or on Intel's 80286 under Concurrent DOS.

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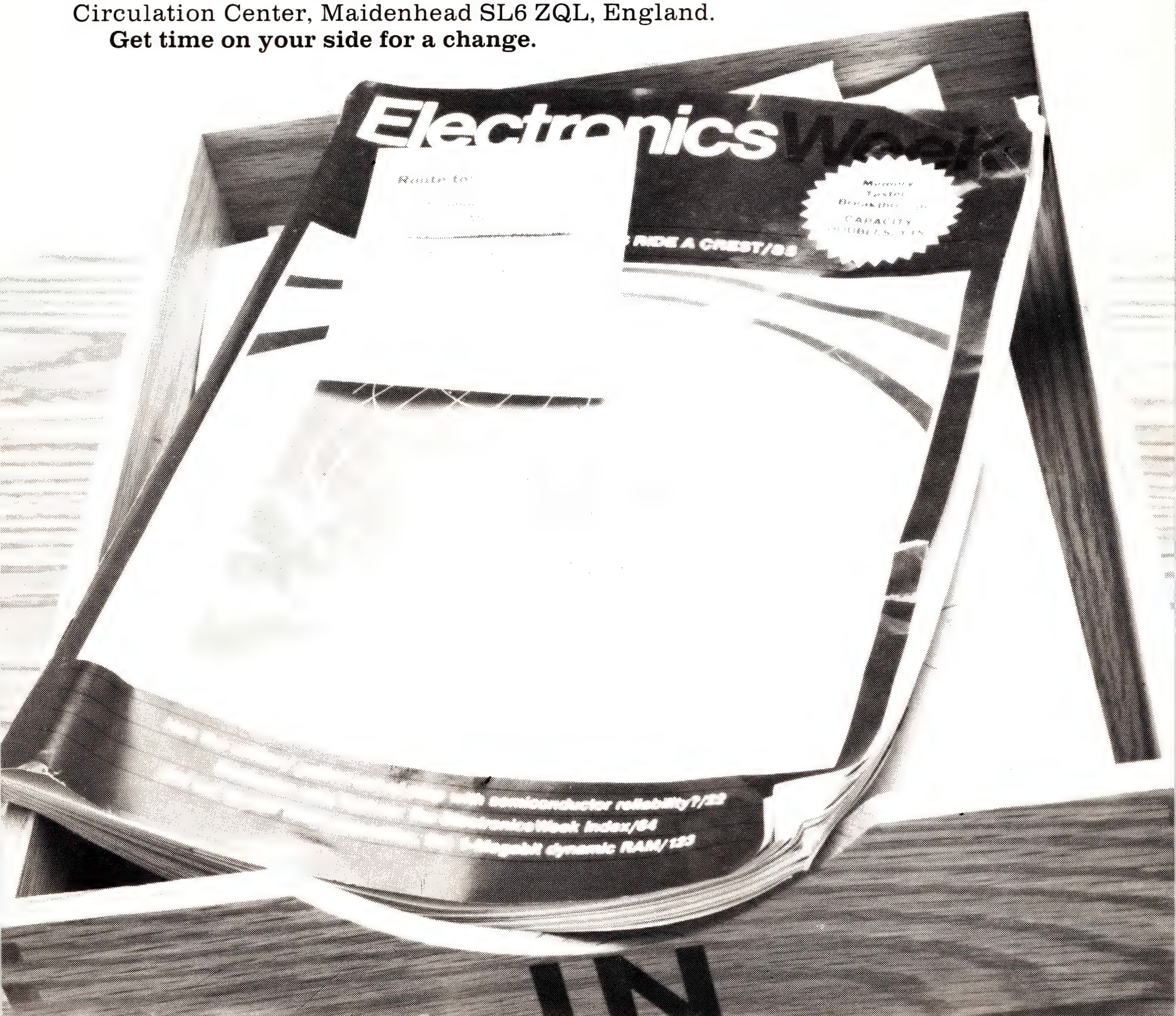

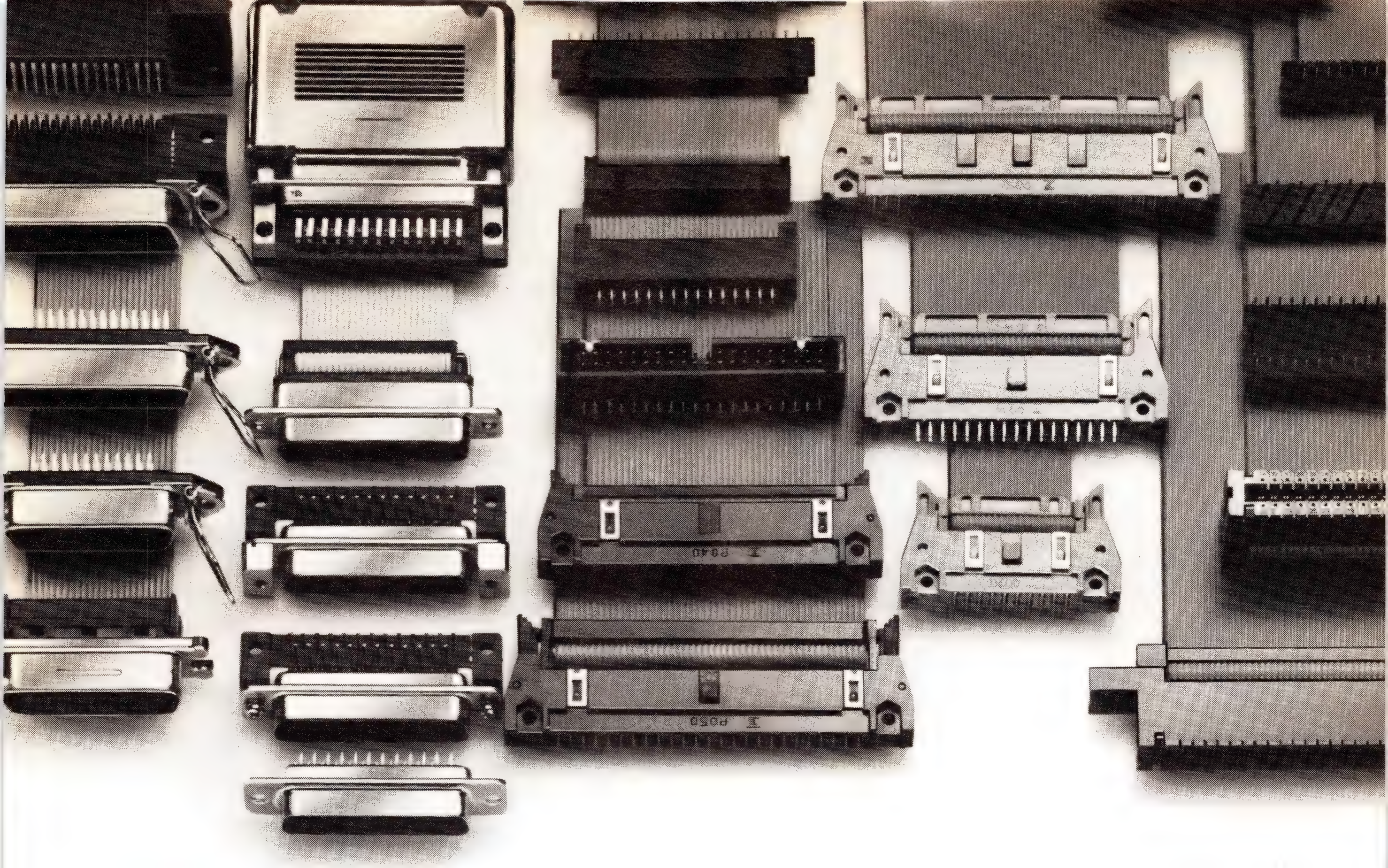

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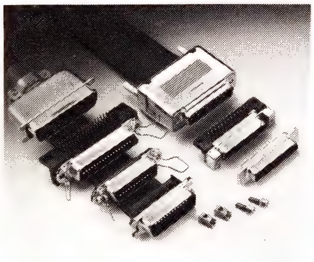

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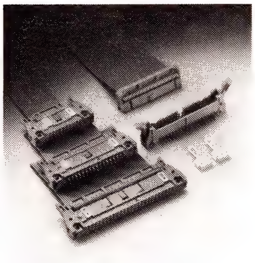

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The Meridian additions are seen by some market observers as an all-out effort on the part of Northern Telecom to permanently unseat AT&T as the leading U.S. supplier. Analysts attending last week's unveiling differ on whether the firm has already taken the PBX lead away from AT&T. But most of them do agree that market momentum has swung in its direction.

"The basic story is that they are stretching funds to the limit with higher inventories, increased capacity, and R&D spending," states Kathy Healy, an analyst with Northern Business Information Inc. Her firm recently completed a comprehensive profile on Northern Telecom, and she believes its hard-won lead in 1984 shipments will likely erode this year as AT&T overcomes the setbacks that resulted partly from the divestiture.

Big Blue is coming. But much more is at stake than huge PBX revenues; it means sales in office computer and data-processing markets will be equally as large. "The announcement definitely pits Northern against AT&T, but in the background you could see Northern looking over both shoulders at IBM. That's because IBM is coming," states Tom Rizzo, a voice/data-communications consultant in Dallas who in the past has advised Northern Telecom's Richardson division. Just like other telephony-system firms, he notes, AT&T and Northern Telecom are quickly attempting to influence new emerging digital-transmission standards over existing telecom-wire highways before IBM settles in with its own office networks.

"It is a marketing attempt to set *de facto* communications standards while IBM has clearly established the computer-operating-system standards," explains Rizzo, whose company is coordinating the maiden Comtel conference March 18-20 in Dallas. The conference, which will cover technical and marketing issues in voice/data integration, will present speakers from AT&T, Northern Telecom, and IBM, as well as other industry leaders. "A couple of years ago, you would have not been able to pull off this conference because there were no products [fully integrated voice/data PBXs]," Rizzo points out. **–J. Robert Lineback**

INDUSTRIAL

FACTORY AUTOMATION ADVANCES APACE

Minneapolis

Factory automation took another step in the direction of standardization last week when Honeywell Inc. announced its formal support of the new Manufacturing Automation Protocol, a system whose main backer is General Motors Corp. Adding its name to a host of industrial heavyweights that are also supporting MAP [*ElectronicsWeek*, Dec. 17, 1984, p. 20], Honeywell has contributed a new factory-automation architecture, with new software and hardware for MAP compatibility.

Among the new Honeywell products is a 68000-based work station called the Work Center Controller 1250, designed to automate the collection and processing of data on factory work in process, inventory, maintenance scheduling, quality assurance and testing, labor data, and other production activities. As part of the new architecture that Honeywell calls its Plant Management System, the unit will work with such other Honeywell components as DPS 6 minicomputers running new software packages dedicated to various in-plant processing tasks.

Leading supplier. "We expect to be one of the leading suppliers of integrated information and control systems for manufacturing automation by the end of this decade," declares Honeywell chairman and chief executive officer Edson Spencer. Honeywell's revenues from manufacturing-automation products already total nearly $1 billion annually, and the firm expects that figure to double by 1990.

With first deliveries scheduled for late this year, the Plant Management System initially will link components using a 10-Mb/s Ethernet. Eventually, it will also support both baseband and broadband versions of GM's MAP. The first DPS 6 application packages for use with the system include production scheduling, utilities management, material movement and storage, and maintenance management. Users will also be able to write their own DPS 6 routines in Fortran, Cobol, or Pascal to supplement the packaged applications.

Bringing it home. Off-site corporate mainframe computers from a variety of vendors can be tied in. By bridging the information gap between in-plant and off-site computers, Honeywell contends that its system provides the ability to perform locally a variety of manufacturing functions that had been done manually on corporate mainframes. "What customers want, more and more, is not simply a collection of the most advanced technologies, but a stable supplier with the vision and resources required to help them build a totally integrated system," according to Spencer.

As more industries rush to automate their factories, suppliers of automation equipment need industrywide standards.

One product that Honeywell sees a coming need for is a controller that integrates the functions of today's programmable controllers and process controllers into a single box. The company plans to introduce such a universal controller sometime after 1986.

Current and future marketing targets include programmable controllers, sensors, and actuators—in addition to process control and manufacturing planning and control/communications systems. These areas, together with controllers for such equipment as machine tools, robots, conveyors, and materials-handling systems, will amount to a $10 billion market this year, rising to $20 billion by 1990 and $37 billion in 1995, the firm estimates. **–Wesley R. Iversen**

ROBOTS COME TO THEIR SENSES

Industry seminar stresses the need for simple sensors; low cost is still more important than high intelligence

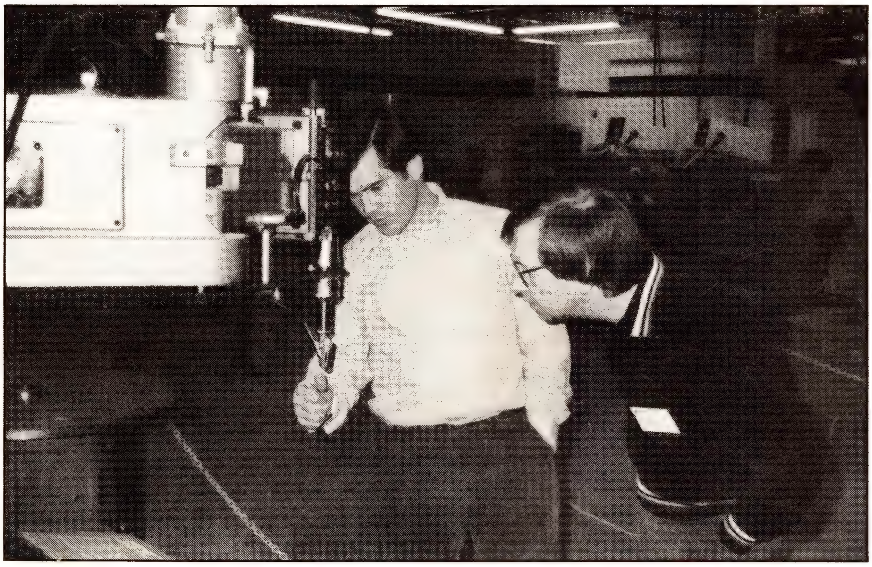
☐ *by David M. Weber*

Atlanta

Robots are useless unless they have a sense of what they're doing. Even a robot arm that can move with great precision can't be used as a manufacturing tool if it doesn't know where to find the objects to manipulate or how to position them in meaningful order. This was a recurrent theme at the workshop sponsored by the Society of Manufacturing Engineers that was held here in late January.

"The notion that machine vision is the latest add-on for robots is patently false," states Owen Herman, chief engineer for vision technology at Robot Systems Inc. "Only about 5% of robots currently in industry use vision. Limit switches and encoders have been around a long time and are doing fine, thank you." Conversely, he notes, only 5% of today's vision systems are used to control robots. The rest are used for inspection and quality control [*Electronics-Week,* July 30, 1984, p. 31].

Power hogs. Many speakers at the workshop suggested that newcomers to the robotics industry often don't appreciate how much computer power is required for even rudimentary object recognition and its subsequent coordination with a robotic limb. A machine usually needs 20 megabytes of random-access memory to be able to see an object in three dimensions—that is, for it to store the visual parameters of a solid figure and remember what the figure looks like when it sees it a second time. If the object has been rotated through a different spatial orientation, the problem is exacerbated.



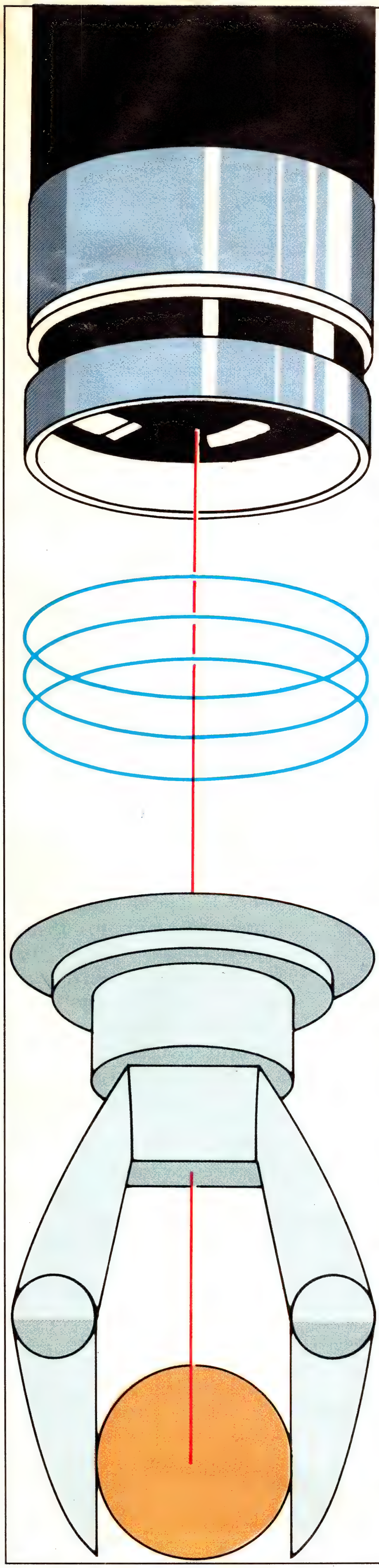
Thumbs up for sensing. A pressure-sensitive transducer in this robot's end effector mimics the human hand: too much pressure, and the robot knows it might do damage. Such sensors are well-suited to direct the manipulation of delicate objects.

Fortunately, less storage capacity is required for gray-scale and binary imaging. In this more simple task, solid objects are viewed in only two dimensions and one spatial orientation, thereby reducing the amount of visual memory needed to recognize the objects.

The drawback is that objects cannot be placed at random in an industrial environment but must be oriented within a rigidly prescribed space for the machine to know what and where they are. Most vision systems on the market have this limitation, whether they are used as robotic sensors or to inspect products. The other limitation is cost.

Dollars and sense. Robot Systems' marketing vice president, Ron Potter, points out that "a $50 limit switch can be just as effective as a $5,000 video camera if a robot is simply repeating a single chore." If they are to be reprogrammed for another task, the limit switches or encoders can be recalibrated to accommodate the new parameters for the robots' motion.

For vision, a specular scan may be adequate to position a robot end effector in relation to an object whose position is fixed (or which is moving down a conveyor belt at a constant speed). Such a scanning setup involves only angling a beam of light from the end effector so that the an-



gle of reflection from the object is constant (or, in the case of a moving object, varies in a predictable way).

Another approach to nonintelligent sensing—sensing that can operate independently of a computer—uses photoelectric proximity switches. In robotics, these switches are applied to the problem of detecting whether a part is present—in the same way an electric eye automatically opens a door when it detects a person in the doorway.

"The biggest concern among manufacturing people is reliability rather than sophistication," stresses Erle Dieter, an engineer with the Acme-Cleveland Corp. "We're more interested in a simple, low-cost system that is rugged enough for the factory than in a sophisticated system that we may or may not find a use for."

The best replacement for the electromechanical limit switches that control most industrial robots might be optical or ultrasonic proximity switches rather than machine vision, suggested Dennis Ball, a marketing vice president at Acme-Cleveland, at the workshop.

In the workshop's hands-on portion, attendees showed a great deal of interest in the use of fiber optics in photoelectric sensing. This rugged technology is especially suited to robotic applications because the small sensing head can be mounted directly on the end effector, without signal interference from vibration or high temperature. In addition, the flexible cable can move with the robot arm and is relatively immune to damage from fluids or airborne particulates, both of which could make the use of a video camera impossible.

Off-the-shelf solution. For example, the Omniprox pulsed infrared photoelectric sensor from Scientific Technology Inc. detects anything entering or leaving its field of view, whether metallic, nonmetallic, liquid, or gas. Both sensitivity (to objects of a given density) and range are adjustable and do not have to be programmed by a computer, though they can be. If a robot's operating envelope changes after it has finished a given task—and not while it is working—the Omniprox, and sensors like it, provide a manufacturer with an off-the-shelf solution to the problem of simple robot guidance.

Similarly, off-the-shelf ultrasonic components such as the camera sonar from Polaroid Corp. are also widely used as solid-state proximity sensors that can be interfaced to a small microprocessor. Little computing power is needed to interpret the sonar readings, and they can be updated in real time.

Desirable intelligence. Using intelligent vision to guide a robot's end effector is an application that is still limited—but growing. In 1984, the $60 million market consisted mostly of such applications as inspection of critical part dimensions, position measurement (especially for checking the placement of holes in printed-circuit boards), seam tracking in industrial welding, and the detection of specific defects for which the vision system's computer had been programmed beforehand.

Joseph Carcone, General Electric Co.'s marketing manager for Intelligent Vision Systems, predicts that for the next two or three years, end-effector manipulation will evolve logically from current practices in industrial inspection. In that time, sophisticated algorithms will be developed that can provide the speed, cost reductions, and precision needed to move a robot through an environment that changes variably.

When a robot's task—even an apparently simple one such as loading boxes of different sizes on a pallet—involves the manipulation of objects that are not identical, merely calibrating a sensor will not suffice. A robot must be given a flexible series of if-then instructions that will permit it to adapt its movements to an environment that changes as the work progresses. Such flexibility presents a sharp contrast to proximity switches, which simply halt a robot's operation when they encounter something unexpected.

Most intelligent robots use vision for their primary sense, probably because most people do. "Even so, current machine-vision systems are inherently two-dimensional in nature," says Carcone. "The most common systems are based on an area-array camera [which processes a picture as a rectangular grid of gray-scale pixels], but there is a growing demand for 3-d imaging that includes surface features as well as edges."

Currently, the computational power needed to interpret the myriad reflections from different features embedded in an object's surface is too costly for commercial use. But within a few years, say many industry analysts, certain high-cost, high-value functions will make 3-d surface imaging practical outside the laboratory. The inspection (and possibly manufacture) of wafer-scale integrated circuits—where surface irregularities could profoundly affect the quality of the finished product—is a promising area.

The 3-d vision systems now on the market are designed not for detailed feature recognition but rather for the gross recognition of a whole object from within a stack of similar (or identical) objects. Paul Hasler, manager of industrial marketing for Visitronic, a division of Honeywell Inc., explains that "to be practical in today's factory environment, it's not necessary for a 3-d system to mimic human capabilities or even to have elaborate artificial intelligence."

Visitronic's approach uses a relatively simple technique called photometric stereo. In this technique, the brightness of light reflected from given points on an object's surface specifies the orientation of the object. Points of equal brightness are interpreted as concentric circles that become wider as the light's intensity diminishes with distance.

A second brightness measurement (from another light source at a known angle to the first) is then correlated with the original measurement to give a unique pair of gray-scale intensities. The relative positions of both bright and dim points on the gray scale can then be built into a crude 3-d image by the associated computer. (Visitronics uses a Digital Equipment Corp. LSI-11/23 central processing unit with 256-K bytes of RAM.)

Not for 3-d. Although crude, the imaging is adequate to tell a robot's end effector how to position an object in a bin so that the object can be removed and repositioned later without damaging it. Though this technique will not be sufficient for 3-d inspection, it can be adapted easily to any number of objects that a robot needs merely to recognize.

A simpler, but less precise, technique than vision for 3-d object recognition is tactile sensing. Unlike machine vision, which can require thousands of pixels to identify an object, tactile sensors usually depend on an array of fewer than 100 active sites—a 10-by-6 format is typical. They can be interfaced to intelligent robot-guidance systems and require less computing power than vision systems to identify an object's outside contours.

Tactile sensors, however, cannot give a robot detailed positioning instructions. A touch-guided robot can rotate something from back to front or set it right side up, but it will not move with the same precision as a robot with sight. And it is useless for inspecting 2-d surface features. Tactile sensors are less common in industry than machine vision is. Nonetheless, they may offer a more economical solution to the problem of orienting and assembling solid objects that don't have a lot of surface detail.

Now you see it. A video camera is interfaced to a minicomputer to render an image into the digital language that even a robot can understand. Background lighting is constant.

The Lord Corp. manufactures two general types of tactile sensor: array and vector. The array obtains patterns of information over the sensitive touch surface. The vector measures the effect of all forces and moments on that surface. The two functions work independently of one another because one is concerned with identifying an object and the other with telling a robot how to position it.

A new feel. One new technology in tactile sensing involves capacitive cells made of a silicon diaphragm: the diaphragm moves against a glass substrate in response to an applied force. Although sensitivities of 1 fF have been reported in the laboratory, many engineers responsible for integrating sensors and robots are wary of the cells' susceptibility to fluctuations in ambient temperature and electromagnetic interference.

Robot Systems' Potter doesn't believe in the current economic feasibility of sensitive tactile equipment. "They are too affected by noise and require too many built-in corrections," he says. "Also, they have to give a digital interpretation of what it is they're touching. It's much easier for an operator to simply see an [analog] image on a video display."

Though the same limitations have applied to another technology used in tactile sensing—piezoelectricity—a new development in piezo materials promises to mitigate them [*ElectronicsWeek,* Dec. 10, 1984, p. 48]. Polyvinylidene fluoride (PVDF) films now being used in prototype sensors are said to offer several advantages over traditional piezoceramics such as lead zirconate titonate (PZT).

PVDF can be subjected to much stronger electrical fields than PZT, as well as to a wider range of temperatures and more severe mechanical stress. It is also a more sensitive piezo transducer.

According to Potter, the best use for tactile sensors is not sensing as such but monitoring a robot's end effectors for force and moment buildup. More capable than simple strain gauges, they can be interfaced to a computer that resolves the forces into positioning vectors (possibly in integration with a vision system) and warns the operator if tolerances are exceeded. □

SERVOS SHINE IN BIG SCOPE

Berkeley, Calif.

The massive mirror of a large conventional optical telescope is undeniably impressive, but nonetheless offers nothing to pique the professional interest of an electronics engineer. The new 10-m parfocal telescope on the boards at the University of California's Lawrence Berkeley Laboratory does.

When it sees its first light in 1992, the $85 million telescope will enable users to view objects of the 28th magnitude. It is built around a spectacular primary mirror that is cut into 36 hexagonal pieces. Keeping these pieces positioned so that the mirror acts like a solid piece of glass requires a similarly spectacular electronic system—an elaborate servo loop that utilizes 108 Motorola 68000 microprocessor chips.

Sophisticated. Staff scientist George Gabor, who has worked on the project since its inception seven years ago and designed its electronics, believes the system is by far the most sophisticated ever used for such a purpose. "Nothing even begins to compare with it. In fact, as far as servo loops go, you'd be hard put to find a more involved one with the precision that's required."

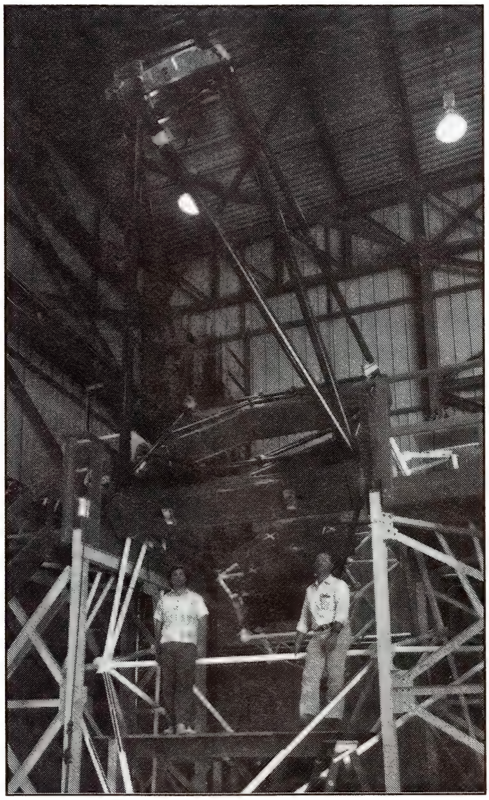
Jerry Nelson, project scientist at the laboratory, dreamed up the mirror's unique optical qualities: six different types of paraboloids, 1.8 m across but only 7.5 cm thick, which form a giant honeycomb surface identical to a solid, 10-m primary mirror. (By contrast, the Soviet Union's 6-m primary, the world's largest in use, is 2.5 m thick.) Gabor's electronic design is a huge, nested servo loop connected to 108 local loops. As a unit, it provides what Gabor calls electronic glue for the joints of the mirror's many-sectioned surface.

Project team member Terry Mast wrote the global algorithm, which is designed to use information from the 168 sensors that physically and electronically connect each mirror segment to its neighbor. Made of the same kind of glass as the mirrors, the sensors are driven by sine waves to measure relative displacement across the tiny gaps between the mirrors, within a range that is approximately 2 nm.

Fast correction. Then the algorithm's transform matrix utilizes the geometry of both sensor and mirror to produce correction signals, which are in turn supplied to actuators. Three actuators per mirror (108 in all) entail the local loops. Correction commands from the sensors travel to local loops; actuators then move to drive the error signal to zero, to null it. This occurs virtually simultaneously throughout the loop before the next sensor reading is taken, locally, in a time span of 10 ms. The algorithm itself, Gabor claims, runs in 51 μm.

The actuator controls movement through a screw-like device that moves the mirror segment itself. Gabor says the phenomenon of stick slip—that is, the tendency for the screw to want to break loose—was one of the biggest obstacles to overcome with electronics. "The motor and screw assembly can break away on the submillisecond time scale. We had to have something that could trap the break-loose screw within 10 nm of motion. That's why we used the 68000, because it could execute the algorithm fairly rapidly."

Function as monitors. Each of the actuator chips operates as a separate central processing unit inside the servo loop, and 46 others function as monitors. "During idle time in the signal path, we'll send patterns down them to test the electronic performance. We expect the diagnostics to be at board level," says Gabor, adding that this function will be enhanced when the project is completed.



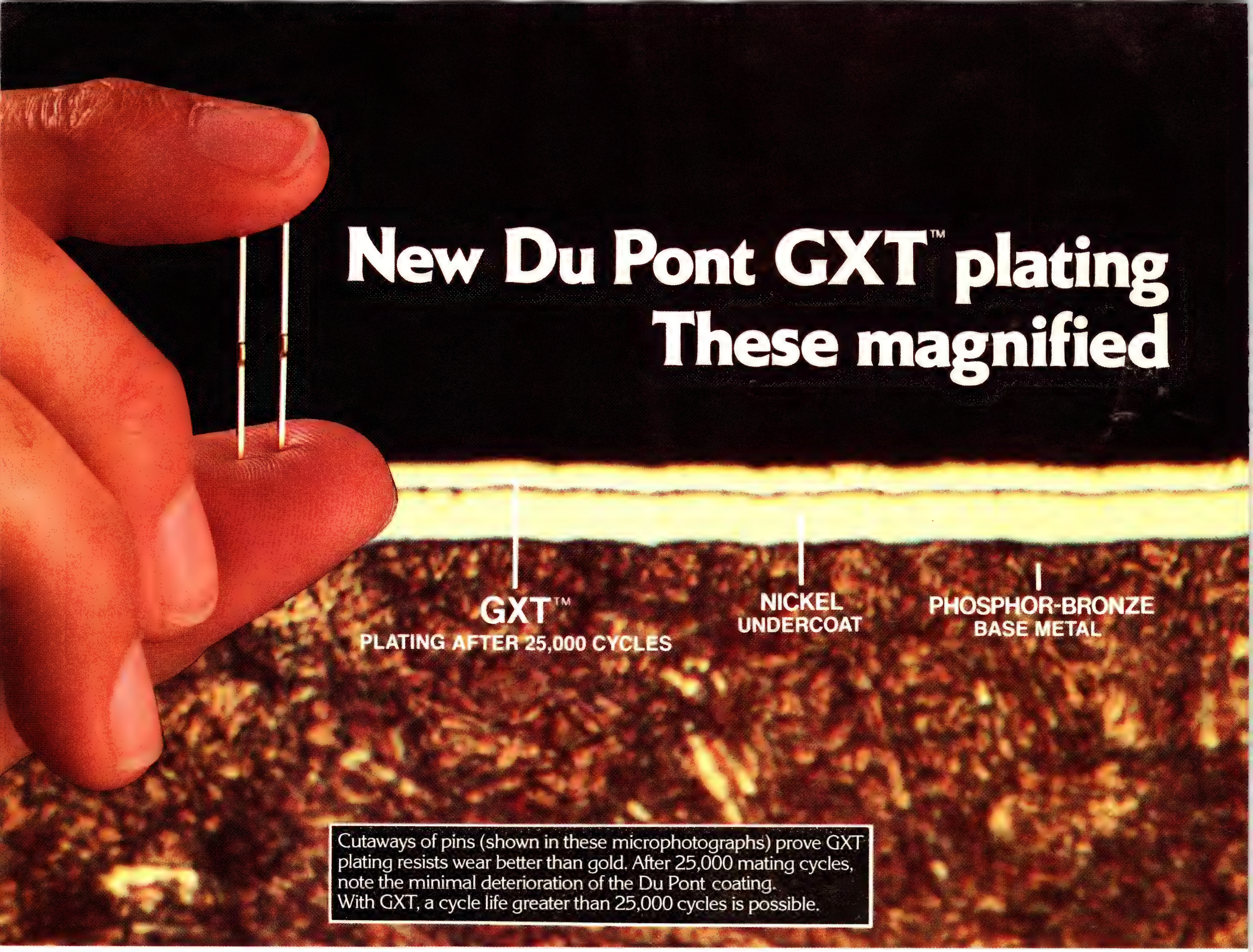
Light bucket. Jerry Nelson, left, and George Gabor of Lawrence Berkeley Laboratory perch atop the working demonstration model of the telescope-to-be, which Gabor calls "a huge light bucket."

The design should be completed within the next 18 months. After that, the telescope will be constructed and maintained jointly by the University of California at Berkeley and the California Institute of Technology in Pasadena. Before that can happen, however, financing for the project must be worked out.

The University of Hawaii has already provided the site—atop a hill with four other large telescopes at Mauna Kea, Hawaii—in exchange for 10% of the observation time on the telescope. The Keck Foundation in Los Angeles has proffered $70 million, but that won't become available until UC Berkeley and Caltech legally incorporate the project. That leaves another $15 million still to be found.

Meanwhile, the development goes on. Gabor's team has an operating model of the scope and has opened bidding for the fabrication of segments. But, he says, "There are a lot of loose ends." **–Denise Caruso**

New Du Pont GXT™ plating These magnified

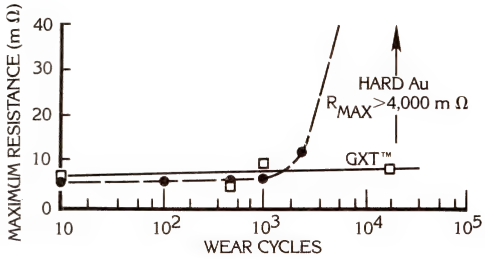


Cutaways of pins (shown in these microphotographs) prove GXT plating resists wear better than gold. After 25,000 mating cycles, note the minimal deterioration of the Du Pont coating. With GXT, a cycle life greater than 25,000 cycles is possible.

Tests also show the GXT plating system is better than gold in solderability, porosity, bend ductility, and corrosion resistance. Yet GXT can reduce costs as much as 20%.

Independent testing laboratories have proved that the Du Pont GXT plating system is *superior to gold* in wear resistance, solderability, porosity, environmental corrosion resistance and bend ductility. And is as *good as gold* in contact resistance and wire-wrapping performance.

Moreover, connectors protected by this remarkable new coating system frequently cost considerably less than comparable parts plated with gold. For example, savings of up to 20% are possible on pins plated with GXT. (Savings depend on the price of gold and upon the amount of gold being replaced.)



GXT assures minimum contact resistance after wear and exposure to H_2S

By 25,000 cycles, gold shows contact resistance increases to 4,000 milliohms or higher. In contrast, GXT shows excellent electrical performance even after 25,000 cycles.

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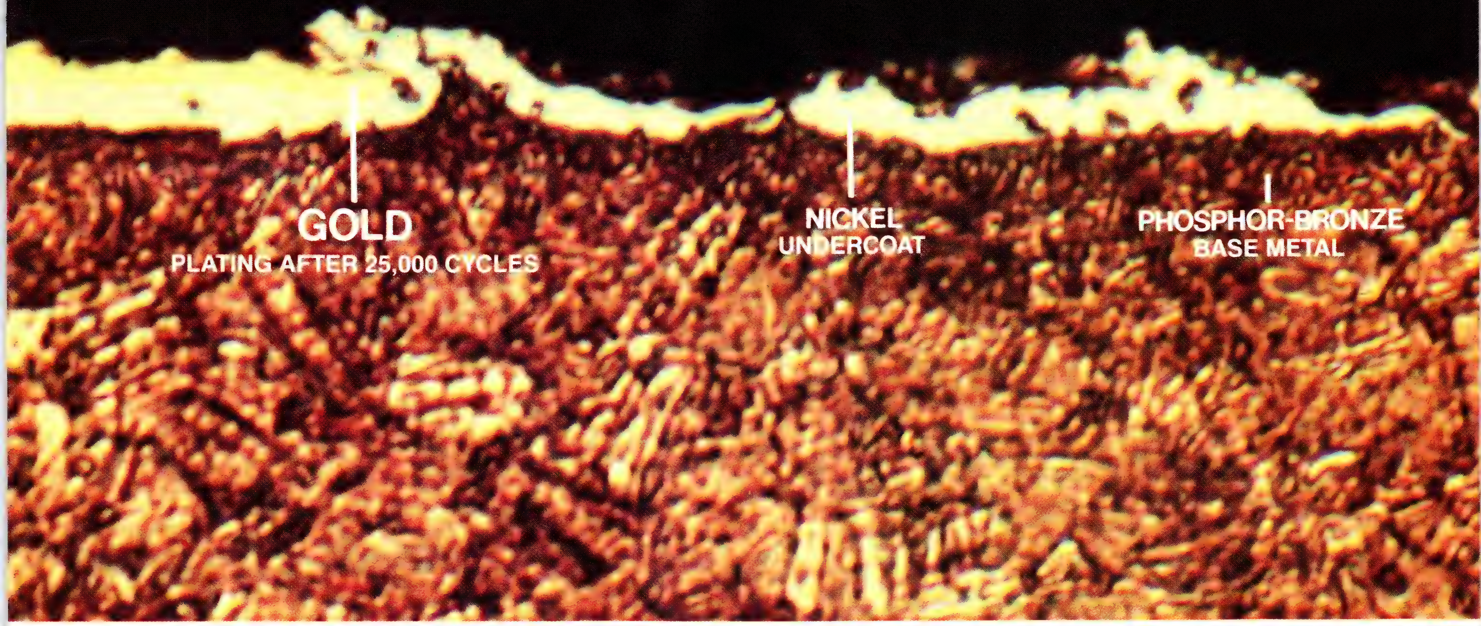

In these tests, other gold substitutes didn't measure up to GXT, either. In porosity, solderability, intermetallic growth, bend ductility, internal stress, and manufacturing process stability, the GXT plating system clearly outperformed all other gold alternatives including other palladium-nickel and pure palladium coatings.

In fact, in no test did any gold substitute—or gold itself—outperform GXT.

GXT plating, an exclusive Du Pont development, is now available on Du Pont's 0.025″ square pins, including BergStik™ headers, BergPost™ and BergPin™ terminals, and compliant press-fit pins. Some industry leaders already have switched from gold to GXT to help improve the reliability of their products.

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SIEMENS ARRAY IS FAST, COMPLEX

Munich

If speed, size, and chip complexity can make a gate-array family a winner, Siemens AG has one.

The south German firm has produced a 9,300-gate bipolar array that sports a delay time of 150 ps for an internal gate. Thanks to a new self-aligned oxide-isolation process that affords a threefold reduction in the base areas of transistors, Siemens was able to pack some 62,000 components onto a 128-mm^2 chip.

"We believe this is the fastest and most complex gate array yet fabricated in bipolar technology," says Walter Bräckelmann, deputy director in charge of integrated-circuit development in the company's Data Systems Group.

Compared with other digital logic chips that were discussed at last week's International Solid State Circuits Conference in New York [*ElectronicsWeek,* Feb. 11, 1985, p. 51], the claim stands up. Gate arrays that are faster than the Siemens chip, whose internal gate delay was clocked at 99.65 ps in an experimental 49-stage ring oscillator, were presented at the meeting, but none of them was nearly as large.

To be sure, there are arrays on the market with upward of 20,000 gates. But these use MOS technology, and therefore these arrays cannot come close to matching the short delays of bipolar circuits.

New-generation chip. Siemens expects to have the first chip of the family—called the SH100E—in production next year. It is intended mainly for new computer generations, but Bräckelmann expects it will also find its way into communications gear, medical electronics, and high-speed test equipment.

Worldwide consumption of gate arrays ran to $737 million last year, according to Dataquest Inc. Bipolar types made up some $337 million of this figure, or slightly more than half. This year's total should run about $1 billion, with $450 million of that bipolar. The new family of gate arrays, Siemens hopes, will substantially boost its market share, which was $20 million last year.

With this chip, the company moves into its third generation of gate arrays; this latest one is twice as fast and twice as dense as its predecessor.

Small and speedy. The latest chips owe their high density partly to their small cell dimensions. The cells—360 by 67.5 μm—occupy only one quarter of the area of the second-generation arrays; what's more, they are packed with practically no space between them.

Speed was doubled largely because of Siemens' new oxide-isolation process. Called Oxis III, this 2-μm bipolar process entails the use of transistors with deep dielectric isolation and polysilicon emitters and bases in a very shallow self-aligned emitter-base structure. The process achieves a threefold reduction of the base area. This makes for a small base-collector capacity that, in turn, enhances the speed performance. Still another lift in speed results from the hole-current suppression within the emitter region.

The 128-mm^2 chip is made up of four main blocks, each with 484 cells. Along the chip's four sides are 256 input/output buffers. Some 1,248 wiring channels are provided for interconnecting the logic functions.

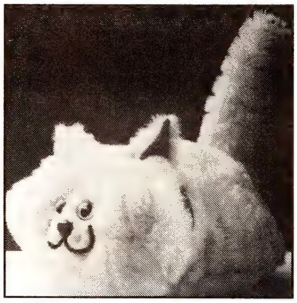
The gates are built around 1-mA current-mode logic switches, which operate with a 500-mV swing. The buffers convert the current-mode levels to standard emitter-coupled-logic levels. Typical dissipation for an array is 20 W. –**John Gosch**

CONSUMER

NEW BRAINS FOR PETS

New York

A new breed of household pet with a whole different mental outlook may be on the scene in the near future. Called Petsters, the electronic creatures made their debut at the American International Toy Fair here last week, and, according to their inventor, they have minds of their own. "We have simulated about 80% of the functionality of the cat and dog," says Petsters' creator Nolan K. Bushnell, founder of Atari Inc. and now chief executive officer of Axlon Inc., the company that makes the creatures.



In time, "Petsters will replace biological animals as pets and companions," Bushnell asserts. And indeed, the furry, stuffed creatures have been endowed with such animate characteristics as mobility, sensitivity to light and sound, and some randomness for individual personality. The brains of these little automatons are contained in a 4-bit custom microprocessor with 4-K bytes of read-only memory and some random-access memory.

Moody. The Petster's primary mode is characterized by one of several randomly selected frames of mind, which range from happiness to sadness, and from lethargy to frenetic impatience. This software-controlled behavior is a response to arbitrary commands from the onboard computer. It is the Petsters' random unpredictability that most closely mimics living creatures.

At a suggested retail price of under $100, Petsters could become one of the next fad toys for Americans of all ages. –**Tom Manuel**

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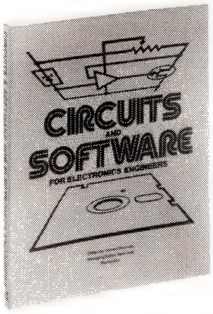

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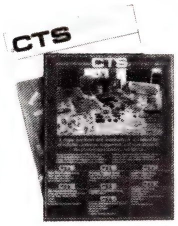

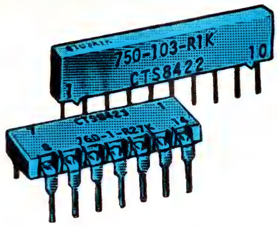

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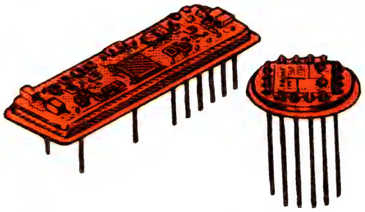

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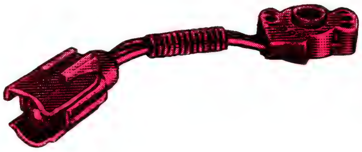

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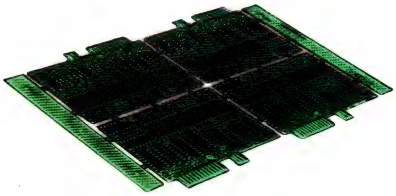

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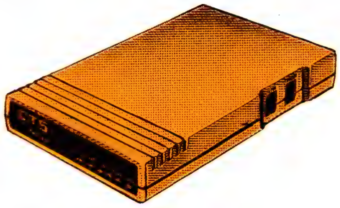

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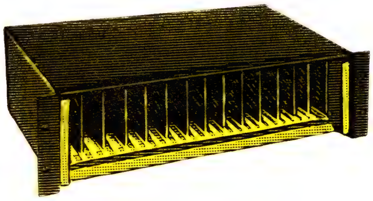

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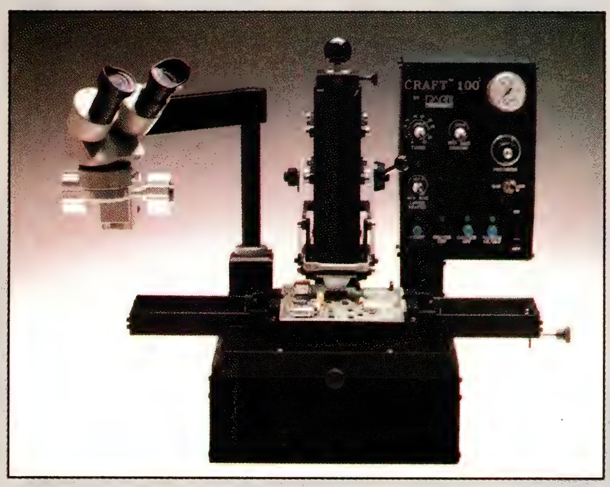

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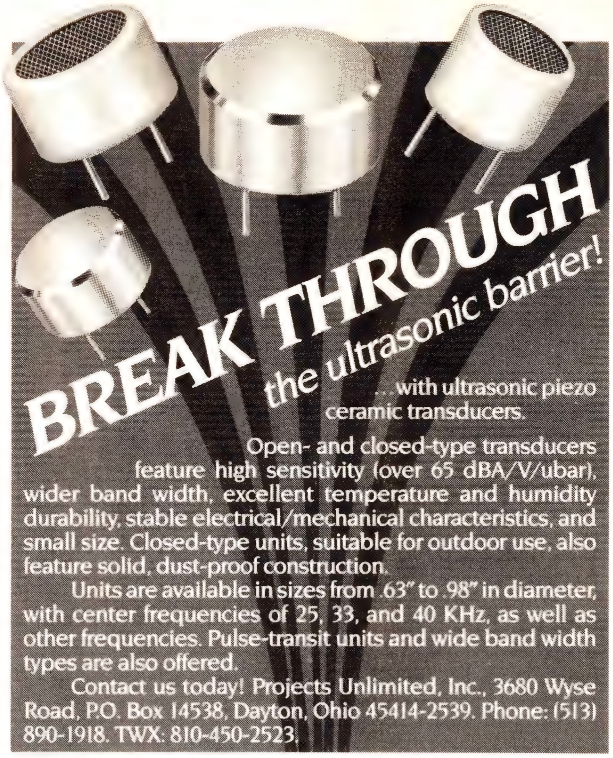

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LASER ENTERS TWILIGHT ZONE

Phase-conjugate optics make filmless holograms, correct distortion, and track objects in uncanny fashion. What's next?

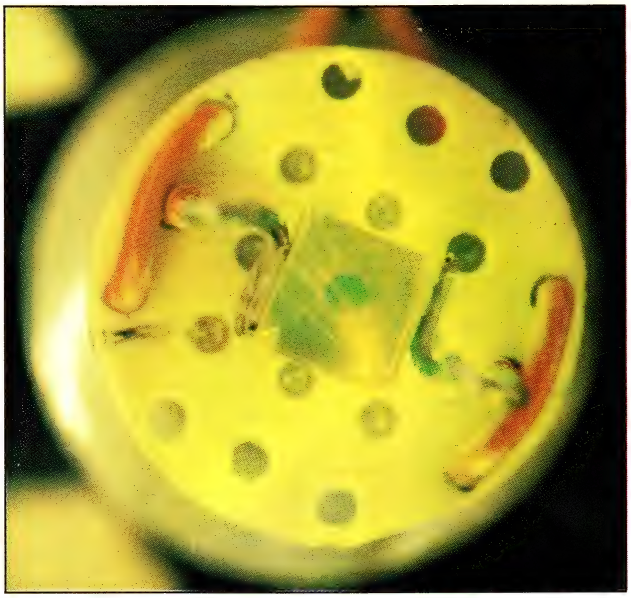
☐ *by Larry Waller*

Los Angeles

Now that lasers have matured from laboratory curiosity to an age of useful commercial application, researchers are stretching into dimensions that may seem incredible to the casual observer.

That is the case in a relatively new laser-related field called phase-conjugate optics. Although the mechanics appear simple, the results are eye-opening. By shining lasers into certain materials, a new laser beam is produced—an exact replica rather than a common mirror image. Moreover, this return beam has two unique features, denoting phase conjugation. Not only does it return to the laser source at the same angle (also unlike a mirror), but in traveling in the reverse direction, the replicate beam behaves as if it were going backward in time.

Researchers call this retracing of the light path a "time-reversal" process and compare it to making a filmstrip run backward. This property at once offers the promise of cleaning up aberrations in distorted beams. If a laser beam carrying an image is distorted (by a faulty lens, atmospheric turbulence, or hardware aging), then its phase-conjugate reflected back through the same distortion can be restored to its original state.



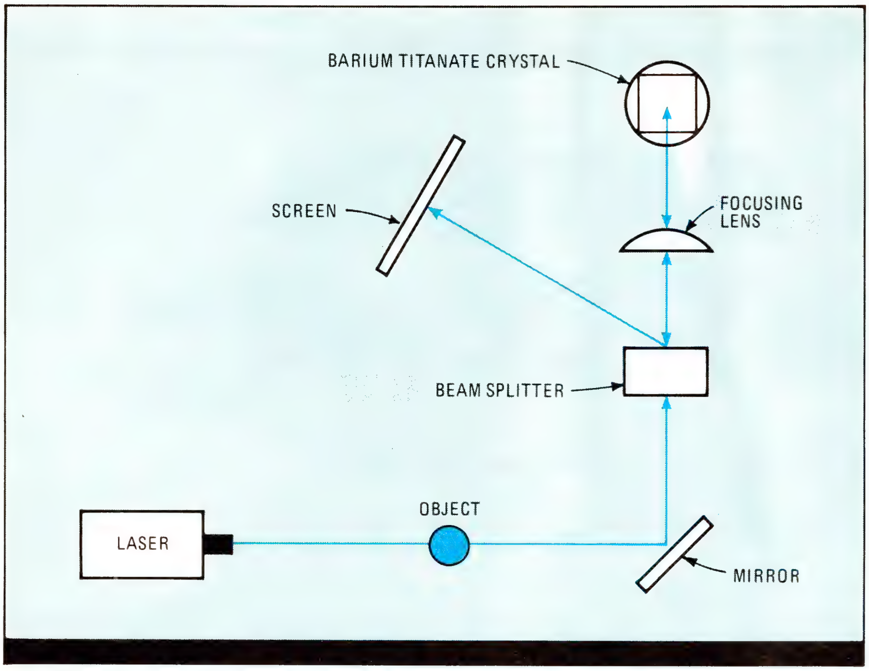
Fan dancing. Work done in Hughes Research Lab shows barium titanate crystal with beam bending and fanning, similar to the geometry that produces a phase-conjugation beam.

Discovered first by Soviet researchers in the early 1970s and picked up in the U.S. several years later, the devices were dubbed phase-conjugate mirrors. But the mirrors were tough to operate—finding an ideal conjugate material proved elusive, and the apparatus was complex and cumbersome. At an early stage, it required three simultaneous, identical laser beams for activation. Still, U.S. military research agencies (and presumably their Soviet counterparts) showed interest and supplied funding. One obvious attraction: the ability to bounce back generates very precise laser-aiming data—a key to targeting laser weapons.

Now a recent development has excited researchers. Replacing previous phase-conjugate mirrors—made with liquid carbon disulfide, silicon tetrafluoride vapor, and even the old transistor standby, germanium—with the crystal barium titanate has opened up new possibilities. Physicists Jack Feinberg and Robert W. Hellwarth first demonstrated phase conjugation in the material in 1979 at the University of Southern California. The familiar yellowish material (commonly used in thin-film capacitors) has shown some surprising properties.

Barium titanate gets its powers from the photorefractive effect, in which light-induced charge migration creates strong electrostatic fields, altering the refractive index. Unlike other materials, barium titanate can be triggered by light at virtually any visible wavelength and has a gain independent of beam intensity. It therefore is activated by a single laser beam of milliwatt or even microwatt levels.

According to Feinberg, the most intriguing part is that the crystal generates its own laser beam with only one input laser, rather than earlier materials using three. It acts as "an optical analog computer." The laser forms an image like a hologram, "but without the film," he says. The incoming beam defocuses



Self-correcting. In a typical laboratory set-up for phase conjugation, a distortion placed between focusing lens and crystal is self-corrected by the conjugation process.

as it passes through the crystal, creating refractivity index variations, which cause it to fan out asymmetrically. The fanned-out beam then hits one edge of the crystal, which reflects it back to interfere with the incoming beam, together producing the phase-conjugated output signal. The entire solid-state process does not happen at light speeds, however, but takes seconds "to find the most efficient optical path."

Fascinating. To date, the time-reversal finding "fascinates an international technical community," in the words of one scientist. A typical benchtop setup (see figure) uses a low-power argon laser, a mirror and beam splitter, a lens, and a screen on which to view the image. The laser illuminates a target object (for demonstrating, usually a pattern) and the optics guide enough bounced light to the crystal where conjugation occurs.

Observers see the most dramatic effect taking place when a distortion (such as a flawed lens) comes between the focusing lens and crystal on the first pass. In spite of the distortion, the image on the screen gradually corrects or self-heals, as it is sometimes called, through the time-reversal process.

Another surprising barium titanate wrinkle, also found by Feinberg, is, if anything, even more dramatic. The crystal can actually track shiny objects around it. For example, when the mirror is operating, a tracking beam pops out of the crystal itself and spots any nearby mirror. He has demonstrated tracking four objects—currently, each one located roughly at 90° angles to the crystal and in the same horizontal plane. The feature will soon be further explored at USC with a higher-power laser. But, notes Feinberg, "I won't be wearing shiny sunglasses in the room."

Although USC gets credit for the barium titanate development, it is just one of the three research institutions in the Southern California area pursuing optical-phase-conjugation improvements. In 1976, Amnon Yariv, professor of applied physics at California Institute of Technology, published seminal papers explaining the theory. At nearly the same time, researchers at Hughes Aircraft Co.'s Research Laboratories confirmed and quantified the Soviet work.

Now efforts focus on the related tasks of improving materials and better defining the process, along with moving toward practical applications. No other material works as well as barium titanate (although several candidates are in the wings). So the push is on to minimize its drawbacks: slow response time and inability to conjugate very weak signals. It is already known that higher laser-pumping intensity speeds response time—each increase of 1 W/cm^2 makes it 10 Hz faster. Research at USC has already shown functioning into the nanosecond region with higher power.

At Hughes, upgrading the crystal is important, and a material-growing project has produced initial products. "We're characterizing them now, and hope to have better data soon for operating them," notes George C. Valley, staff physicist. The only commercial source for the crystal is Sanders Associates. The price is about $1,500 for a 0.5-cm-diameter crystal. Data is scanty on them, says Valley, and "only the best can be self-pumped [conjugated]."

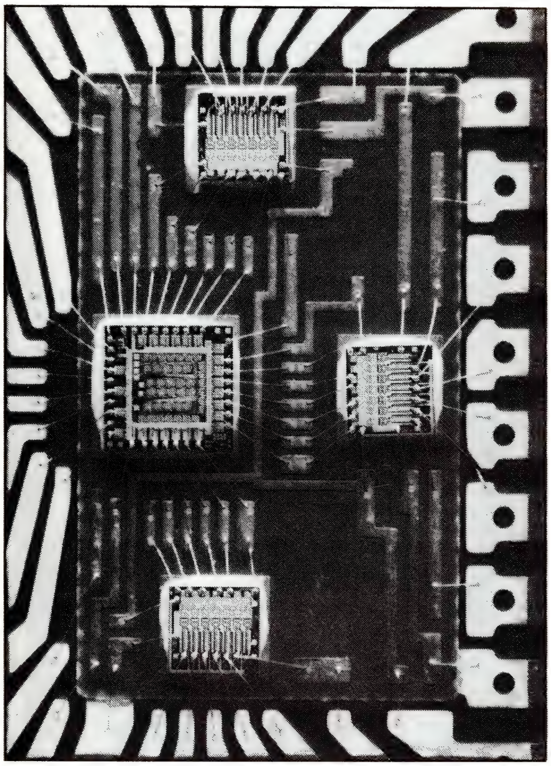
Swings both ways. In seeking applications, Hughes has already demonstrated how a mirror can clean up laser-beam data that has been distorted by shimmering air rising from a hot roof. A workable system for this task would be a coup in eliminating costly and complex electromechanical components. But researchers note that as demonstrated, this solution is impractical in communications where data is carried in one direction. "It's talking to yourself," says one scientist, who explains that the cleaned-up data never reaches the destination.

Caltech has one experimental answer: adding a laser probe beam from the destination side that takes part in a separate conjugation process before bouncing back with the corrected data.

For the future, scientists are certain that payoffs will come with improvements. Feinberg estimates that about 50 U.S. scientists are working on conjugation. Soviet research is at least pacing that in the U.S.: not only were the Soviets first in the field, they have continued to progress and discovered photorefractive materials at about the same time as Feinberg. He received the patent in December.

A sure sign that industry interest in phase-conjugation is building should come at the spring CLEO conference in Baltimore. International laser and electro-optic scientists will hear at least two sessions on this topic. A high point could be the appearance of N.K. Kukhtarev, the noted Soviet authority, if he accepts an invitation to report on developments in his country. ☐

NEC FASHIONS NEW FAB PROCESS



Helpful. NEC Corp.'s Compact process for making hybrid integrated circuits results in products that are smaller, less expensive, and more reliable than conventional hybrids.

Tokyo

NEC Corp. has developed a new way to fabricate hybrid integrated circuits that results in products that are smaller, less expensive, and more reliable than conventional hybrids. In addition, the new process is compatible with the processes NEC now uses to make monolithic ICs.

The new hybrids, which NEC calls Compact (for Circuit Organized by Multiple Passive and Active Chips Transfer mold package), are encapsulated in the same transfer-molded packages as standard monolithic ICs. Internally, they feature a polyimide wiring board onto which bare monolithic ICs are bonded. Wire bonds run from the chips to the lead frame and the wiring board as well as from the wiring board to the lead frame. Other active and passive chips are used as necessary, including multiple and discrete transistors and diodes, chip capacitors, and resistors.

NEC is already using the process on one of its standard parts, a three-phase motor driver for video cassette recorders. The product originally consisted of a linear IC, three thick-film resistors, six power transistors, and one diode on a ceramic thick-film hybrid in a single in-line package configuration. Leads had to be dip soldered, and then the package was sealed by immersion in phenolic resin.

The Compact version was redesigned with the same IC, three chips (each with a resistor and power transistor), and a fourth chip with three transistors and one diode. The combination of fewer parts and fewer production processes has resulted in a cut in the price—from 320 yen, or about $1.24, to 270 yen, or about $1.04).

NEC also uses the process on a four-chip driver for fluorescent display panels it makes at a rate of about 50,000 a month. Three chips provide a total of 20 high-voltage, high-current drives. (Each chip has seven outputs, but multiple hybrid circuits are needed to drive a single display.) One chip has four separate 5-bit shift registers and associated circuits to perform serial-to-parallel conversion for serial inputs.

Two rows. The driver was originally made on a thick-film ceramic circuit board, packaged in a custom-molded epoxy case, and sealed with a urethane resin, says Fumitaka Tomiki, assistant manager of the First Engineering Department of NEC's Semiconductor Application Engineering Division. Because the driver has two rows of leads, separate dip-solder process steps were required before packaging to obtain leads on two sides of the substrate.

For the Compact product, the only process steps are die bonding, wire bonding, and molding. At the current rate of about 60,000 units a month, the cost of the Compact product is only about 85% that of the old driver. For 100,000 units a month, the cost would be only 70% to 75% that of the old product.

In addition to lower assembly and product costs, the Compact products require only about 70% of the board area and only about 40% of the volume of the hybrids they replace.

Other major suppliers say they have no plans to make similar devices at present. They say, though, that NEC appears to have developed an attractive product.

Many advantages. For users, the new hybrids offer a large variety of component products, fast turnaround time, and eased automation of board stuffing. Essentially, all types of chips—including microprocessors and peripheral chips—can be used with Compact, but NEC is de-emphasizing low-power Schottky TTL in favor of high-speed CMOS logic.

The linear products include industrial and consumer types. The turnaround time is four weeks for samples, eight weeks for mass production. Automation is simplified because packages are the same as ones for monolithic products in the same system.

To automate its process, NEC has installed automatic multichip mounters and multichip bonders on the fabrication line at its Sagamihara plant. Tomiki says monthly production should reach at least 200,000 to reap the benefits of automation.

NEC is now talking with customers who want to package more conventional digital chips in this manner, Tomiki says. These include one-chip microcomputers and/or memory chips, input/output chips, gate arrays, and analog-to-digital converters. Packaging several chips in this manner can result in significant savings for users because individual chips are less expensive than their packaged counterparts. Unpackaged chips, on the other hand, are not readily available. –**Charles L. Cohen**

TELEPHONES

SINGLE-CHIP CARD DOES SWITCHING

Antwerp, Belgium

The technology of public telephone exchanges will improve significantly late this year, according to ITT Corp. That is when the firm will begin delivering its System 12 digital central switches, equipped with an all-solid-state subscriber-line-interface card.

For telecommunications-network operators, the card points to lower costs. For subscribers, it should improve reliability dramatically.

Central to the card developed at the research laboratories of Antwerp's Bell Telephone Manufacturing Co., ITT's principal Belgian subsidiary, is its HVX high-voltage switching-circuit chip (see figure). The chip integrates eight high-voltage switches and their low-voltage control logic.

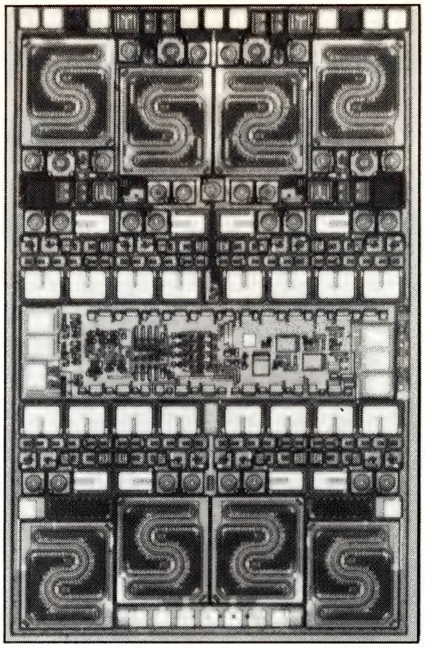
The high-voltage switches replace the miniature electromechanical relays that perform functions such as connecting the test bus to the line circuit. The test relay had been the major stumbling block to an entirely solid-state subscriber card.

Essentially, the HVX is a custom integrated circuit that is used as a switching cross point between the analog subscriber line and the circuit equipment. It connects the subscriber line to the analog front end of the line circuit, the ringing signal generator, and the inward and outward test units.

Double diffused. To produce it, ITT will be using a double-diffused MOS (D-MOS) process that permits the integration, on the same dielectrically isolated substrate, of Tri-MOS (for triac-MOS) transistors that serve as the high-voltage switches and of low-voltage CMOS logic-control circuitry. The engineers at Bell Telephone Manufacturing chose the Tri-MOS transistor because it offers the lowest on-resistance-versus-area ratio of all the available switching schemes. Furthermore, it can be used to implement a bidirectional chip in a single isolation area.

In operation, the switches display a characteristic resistance of 6,000 Ω in their MOS off state (when voltage between the terminals is less than 0.8 V). In the on state above that voltage level, the switch acts like a triac, and the resistance falls to 10 Ω or less. The circuit can withstand at least 300 V.

Own technology. Merchant IC houses are lining up to sell standard circuits to telecommunications-equipment manufacturers to fulfill the subscriber-card Borscht functions (battery feed, overvoltage protection, ringing, supervision, coding-decoding, hybrid conversion, and testing). But ITT has stuck to its own technology because it is convinced that up to one third of the value added in a digital exchange is in the subscriber card.



SLIC. S-shaped triac-MOS switching transistors on ITT's line-card IC are double diffused.

By contrast, other European manufacturers such as CIT-Alcatel, Italtel, and Siemens have development contracts for subscriber-card circuits with IC producers such as Italy's SGS-Ates and Harris Corp.'s Semiconductor Products Division in the U.S. – **Robert T. Gallagher**

AUTOMOTIVE ELECTRONICS

SAAB SPARKS UP

Stockholm

Saab-Scania AB has hope to offer the millions of motorists in Europe and the U.S. who struggled to start their cars in last month's record-breaking cold.The Swedish automaker is introducing a new ignition system that aims to make cold-weather starts a snap by supplying high energy to spark plugs without losses between plug and ignition coil.

Up to now, 200 cars have been fitted with the Saab Distributed Ignition system, but motorists will have to wait a couple of winters more for it. If it proves successful after two years of field testing, Saab will offer it on 1987 models.

Saab used an existing technique—capacitive ignition—for its scheme. The technique, however, has been used mainly on high-performance two-stroke motorboat and motorcycle engines as well as on some four-stroke racing cars.

But Saab had to overcome some major drawbacks to capacitive ignition. Aside from radio-frequency interference, there is the matter of safety: ignition voltage in the new system builds up to 40,000 V, as opposed to 25,000 V in conventional systems.

Sparking time. Further, there is the problem of short sparking time. Saab's system is rated at 1 μs, compared with a rating of 20 μs in a conventional ignition system. A capacitive iginition system's spark must be precisely timed, say Saab specialists, or the emission level will get out of hand, especially at low speeds.

Hans Johansson, the 35-year-old developer of the distributed ignition technique, thought of applying capacitive systems to four-stroke engines while a student at Chalmers Technical University in Gothenburg, Sweden. His idea, turned down by Volvo AB, got an ear from Per Gillbrand, head of Saab's engine development department. "New electronics has given us the chance to eliminate fundamental disadvantages of the capacitive system," he says.

Two-stage step up. Saab's system differs from a conventional inductive system in that voltage is stepped up in two stages. In a conventional system, the 12-V battery supply is stepped up in the coil to some 25,000 volts and distributed to the spark plugs. The Saab-Scania method steps up the supply to 400 V in a capacitor. That voltage is then discharged through an ignition coil to obtain 40,000 V.

In Saab's arrangement, the capacitor fits onto the coil, which in turn is fitted directly onto each spark plug. There are no long high-voltage wires—the entire unit snaps onto the four plug ends and fits over the engine head.

With a Hall-effect sensor fitted near the crankshaft, distributed ignition provides a spark-firing accuracy of ±0.5°, compared with the ±3.0° of a conventional distributor linked to the camshaft. Signals are sent to a microprocessor, which initiates properly timed firing pulses, and also compensates for engine load and speed.

To overcome the problem of very short firing time, Johansson says he simply expanded the gap between the spark plugs' electrodes to 1.5 mm, compared with 0.6 to 0.8 mm for conventional plugs. Ordinarily, this would cause a flash-over elsewhere in the system or result in a weak spark. But because the coil fits right on the spark plug and because the voltage is so high, neither event occurs.

Delco's response. Gerald E. Rigsby, chief engineer for ignition systems and control at General Motors Corp.'s Delco Remy Division, admits that the Saab-Scania system "probably does plow some new ground." He adds, however, that his division is starting to introduce its Direct Ignition System, which he describes as a step between a conventional system and Saab's coil-per-cylinder approach. **–Robert Skole, McGraw-Hill World News**

News Briefs

AT&T shatters fiber-optic speed record

Researchers at AT&T Bell Laboratories have doubled the record-setting transmission rate they set last year by sending data at 4 billion bits/s through a 100-km glass-fiber link having no repeaters. Bell Labs performed the feat using two distinct techniques. In one, the researchers directly modulated a vapor-phase buried heterostructure distributed-feedback transmitting laser, turning it off and on at the 4-Gb/s rate. In the other technique, they generated a steady beam with a cleave-coupled cavity laser and modulated it with an integrated optical switch. This device shunted the beam into or out of the fiber path in response to a 4-Gb/s signal. The modulation made possible a higher power laser, and with it a transmission length of 117 km was achieved.

Herwig Kogelnik, director of photonics research for Bell Labs, reported the record-breaking result at the Eighth Conference on Optical Fiber Communication in San Diego last week. "To our knowledge, it's also the first time that anyone has used an integrated optical switching device in a meaningful lightwave system experiment," he said. By demonstrating two practical modulation schemes at high bit rates, the Bell researchers say they have opened up new options for designers of future commercial systems.

Optical-disk-drive suppliers, controller makers seek interface standard

Makers of write-once optical disk drives and manufacturers of disk-drive controllers are trying to hammer out a standard interface before the optical drives start hitting the market later this year. Representatives of more than two dozen companies—including many suppliers of magnetic drives, all of whom have optical drives in the works—met last month to discuss a protocol based on the Enhanced Small Disk Interface for high-performance magnetic drives. Although there is by no means agreement that ESDI is the proper vehicle for a standard interface (because optical drives differ sharply from their magnetic counterparts, especially in their error-correction requirements), a draft specification based on a proposal written by Information Storage Inc. is being circulated and will be discussed at a second meeting next month.

Battelle studies new way to plate plastic components with metal

A new way to make metal-plated plastic components at 30% to 50% less than present costs is being developed by the Battelle Memorial Institute's Columbus Laboratories. The technique—called in-mold plating—could permit the fabrication of a variety of lightweight parts for computers and for business and comunications equipment, among others. "A wide range of applications for the electronics industry is envisioned, particularly where electromagnetic and radio-frequency shielding is needed," a Battelle representative says. The technology may also be suitable for fabricating molded printed-circuit boards. A number of firms are now sponsoring the research to advance the in-mold plating process toward the pilot-plant manufacturing stage, but nonetheless Battelle is soliciting additional participants.

SEH America sees wafer plant on-line in second quarter

SEH America Inc., the Vancouver, Wash., subsidiary of Shin-Etsu Handotai Co. of Tokyo, says its new epitaxial-wafer manufacturing plant will be in operation by the second quarter of this year. The $33 million, 62,000-ft^2 plant will be able to produce approximately 100,000 epi wafers a month, according to John Matlock, vice president of technology. "Production will be responsive to the accelerating market demand for 150-mm epi wafers, as well as the continuing need for 100- and 125-mm wafers," Matlock says. When the plant is up and running, the company will then start the second phase of its three-phase expansion plan. Each phase is designed to double the plant's original capacity. The new plant is part of a $78 million complex that includes facilities for making single-crystal silicon ingots and for production of polished wafers with 100-, 125-, and 150-mm diameters.

CAE/CAD BESTS ANOTHER BEAST

Vendors exorcise the 'black magic' mystique that has inhibited automation of microwave circuit design

☐ *by Terry Feldt*

New York

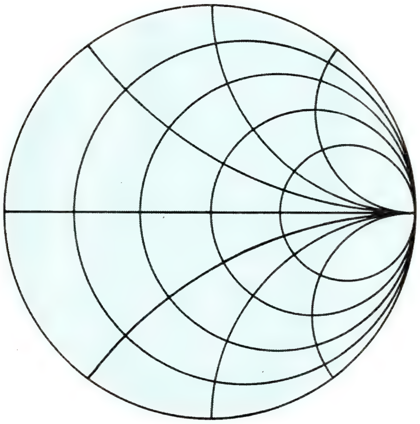
Microwave designers, still trying to digest the implications of last year's infusion of personal computer software for computer-aided engineering, will be hit with still more powerful design software in the coming months. Microwave CAE vendors will be expanding their work-station arsenals to include functions for computer-aided design—for example, software that handles the instantaneous conversion of a circuit design into mask layouts for display or for plotting.

New CAE and CAD software is a welcome tool for microwave-circuit designers, who can couple the economy of work-station CAE with the benefits of automatic layout—all without leaving the office. With CAD layouts, an optimized microwave integrated circuit is displayed or plotted right at the the engineer's work station. The circuit's physical realization can then be visually examined for conformity to form factors, and the engineer can even modify the layouts and analyze the effect on circuit performance.

Old black magic. Stemming from the parasitics that creep into circuitry operating above 1 GHz, a "black magic" mystique has traditionally been associated with this technology. Such a reputation has contributed to making microwave circuit design a notable holdout to CAE/CAD automation—particularly in comparison to the inroads made toward the automation of digital ICs.

"Digital CAE is mostly an application of modern computer science. On the other hand, microwave CAE requires more judgment and experience," says William Childs, executive vice president of EEsof Inc., a vendor of CAE/CAD software.

Like its competitors, EEsof stresses its staff's circuit-designing credentials at least as much as its software-development abilities. Expertise in this specialized field becomes all-important when marketing CAE and CAD to mainstay design firms—currently estimated at 1,600 and up, worldwide—not to mention those companies that may be waiting to get a foothold in the industry with a minimal initial outlay.



Raising a company's in-house microwave IC-design capability can be done more easily by introducing CAE and CAD than by simply enlarging the engineering staff. One reason is that such design experience is hard to come by these days. "We are able to market to startup companies as well as to established firms because of the acknowledged shortage of microwave talent," explains Steven March. He is manager of microwave development for Compact Software Inc.

Compact Software began selling its time-shared CAE software, Super-Compact, to mainframe and minicomputer users more than 10 years ago. "Overall, we are the industry standard," says Henry Wong, director of marketing and sales. "We've got the trained user base that is familiar with our input-file format."

In planning its move to the domain of the IBM Corp. Personal Computer, the company realized that systems hosted on the Digital Equipment Corp. VAX sometimes became overloaded. Hence, one application of its planned work-station software would be to reduce the processing load that a VAX carries.

In adapting Super-Compact to the IBM PC/XT and look-alikes configured with the 8087 numeric coprocessor, then, Compact Software set its sights on the upward compatibility of its new product with the older time-shared systems. "Let the PC do what it does best—provide a user interface," says Wong. Shipments began in December of last year.

Mainframe power. As in the mainframe- and minicomputer-hosted versions, microwave circuit analysis with the Super-Compact PC starts from user-entered circuit-element models and interconnections. According to Wong, the PC version is capable of supporting "basically identical functions" as the mainframe and minicomputer versions.

Circuit characteristics such as scattering parameters, group delays, and noise figures are obtained from the specific characteristics of the circuit's components. Users can optimize circuit performance simultaneously with analysis.

Available component models include lumped, distributed, and bonded elements—such as transistors—chosen from a library of discrete components, and microstrip discontinuity elements. The software also has a tweaking editor for varying individual component values without reprocessing the entire host circuit.

An add-on program allows transmission-line elements to be synthesized independently of circuit analysis and optimization. The optional software calculates a transmission line's physical dimensions from the desired electrical parameters. The program handles microstrip and stripline as well as suspended-substrate technologies.

Next up for Compact Software is to fill out this CAE complement by supplying a work-station version of its layout software. Wong expects this product to be shipped before the end of the first quarter of 1985, and that about 40% of existing Super-Compact PC customers will buy it.

Soft on PC. EEsof, in contrast, has no installed base of mainframe and minicomputer customers that it has to maintain software compatibility with. The company markets CAE/CAD software for personal computer users only, and EEsof expects to ship the first of its layout software by the end of this month.

In a new wrinkle to be added to the layout system (see photo), EEsof will supply a sharp diamond stylus to replace the pen on a Hewlett-Packard Co. plotter, so that rubylith is cut directly—in lieu of plotting the artwork in ink. From there, masks are generated through photographic reductions.

EEsof's layout program and the companion circuit-analysis program—first shipped last July—have a common hierarchical data base, which makes for easy interaction between the engineering and design tasks. For example, a layout can be tuned by changing the dimension of a circuit's displayed feature, while the engineering software steps back in to re-analyze the modified circuit, thereby showing the effect of the tuning on the circuit's performance.

With this level of responsiveness, EEsof is attempting to simulate the laboratory environment, according to Charles Abronson, the company's president. Without CAE/CAD, developing the intuitive feel required for microwave-circuit design used to take years, he states.

Hence the latest generation of software not only reduces the turnaround on new designs—allowing for at least a tenfold productivity improvement, Abronson believes—but it also shortens the learning curve. "I think someone could be adept in a few months using CAE/CAD tools that really simulate the laboratory environment," he says. Abronson projects that 70% to 80% of EEsof's installed base of over 100 companies will add the new layout capability this year.

According to Wong, Compact Software, too, will provide for more interaction between its new layout software and Super-Compact PC. "This is planned," he says.

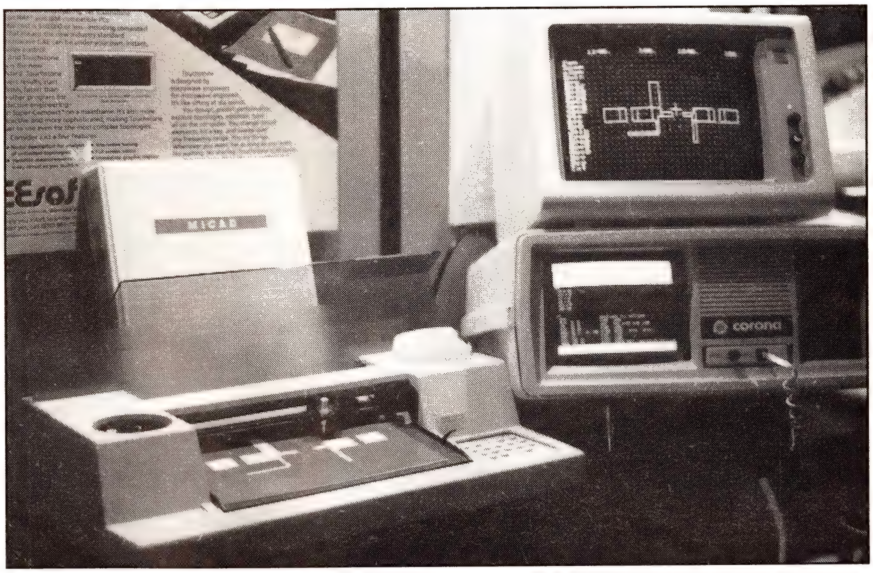
Speed frills. One obstacle to be overcome in increasing the responsiveness—and therefore the usefulness—of CAE work stations is processing speed. From the beginning, EEsof targeted its software design for personal computers.

EEsof's programs are totally resident in random-access memory to eliminate delays in fetching program segments from disk, and the routines employ minimal branching. The speed benefits of these techniques were underscored at the late-January RF Technology Expo in Anaheim, Calif., when Childs presented the results of a benchmark comparison of the EEsof CAE package run on an IBM PC AT versus Super-Compact run on a dedicated VAX. The PC AT took 1,352 s to optimize a filter diplexer; Super-Compact hosted by the dedicated VAX was only 279 s faster.

Accuracy targeted. Another CAE/CAD software vendor is Communications Consulting Corp., a small New Jersey firm. The company is looking first to enhance the accuracy of software and thereby expand the scope of applications.

The firm markets a variety of radio-frequency and microwave CAE/CAD programs for personal computers, including a general-purpose analysis and optimization package. The latter has been installed on some 1,500 systems since its introduction four years ago, according to Ulrich L. Rohde, president of Communications Consulting.

Communications Consulting's latest offering is a dedicated microwave version of its original program. The new one is accurate enough to handle frequency ranges up to 100 GHz, he says, and the company has announced companion layout software to be shipped in May of this year.☐



Easy. Software from EEsof Inc. features not only the interactive design of microwave integrated circuits but also the direct cutting of rubylith for preparing fabrication masks.

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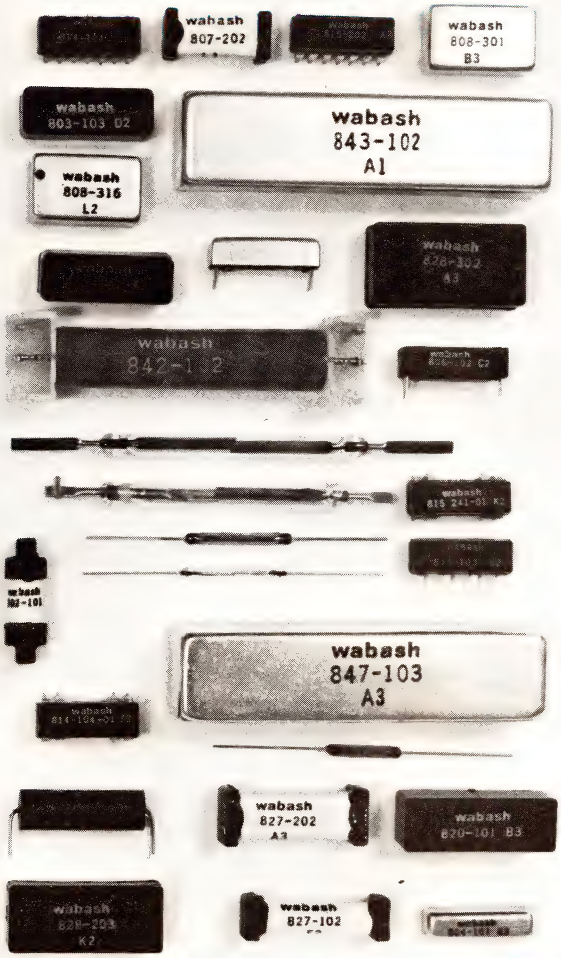

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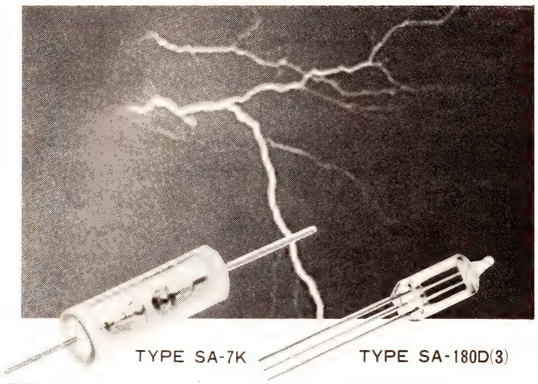

● *TYPE*

Type	Breakdown Voltage (V) DC	Insulation Resistance (Ω)	Maximum Surge Current (8 × 20us) KA	Life Times at 500A
SA-80SS	80 ± 10%	10^{10} min	1.0	1000
SA-200SS	200 ± 10%	10^{10} min	1.0	1000
SA-80	80 ± 10%	10^{10} min	1.5	1000
SA-140	140 ± 10%	10^{10} min	1.5	1000
SA-200	200 ± 10%	10^{10} min	1.5	1000
SA-250	250 ± 10%	10^{10} min	1.5	1000
SA-300	300 ± 10%	10^{10} min	1.5	1000
SA-7K	7000 ± 1000V	10^{10} min	—	5000
SA-10K	10000 ± 1000V	10^{10} min	—	5000
SA-180D(3)	180 ± 10%	10^{10} min	2.5	1000

SA-180D(3) is a three electrode discharge tube
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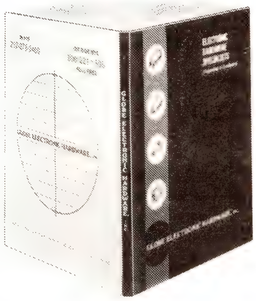

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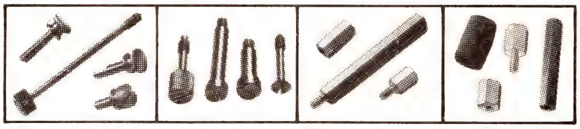

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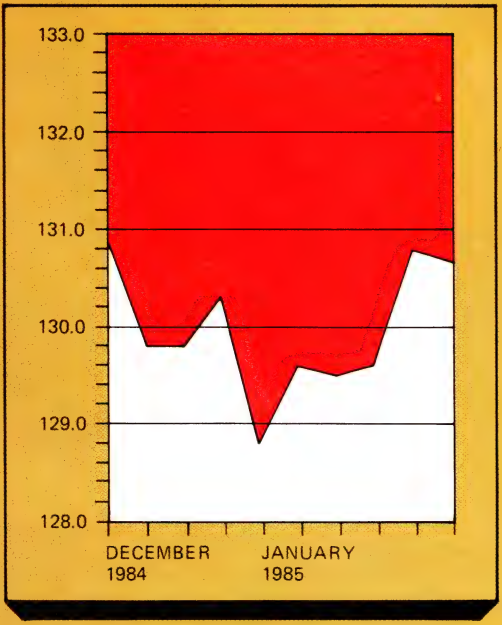
ElectronicsWeek Index



THIS WEEK = 130.7
LAST WEEK = 130.8
YEAR AGO = 120.0
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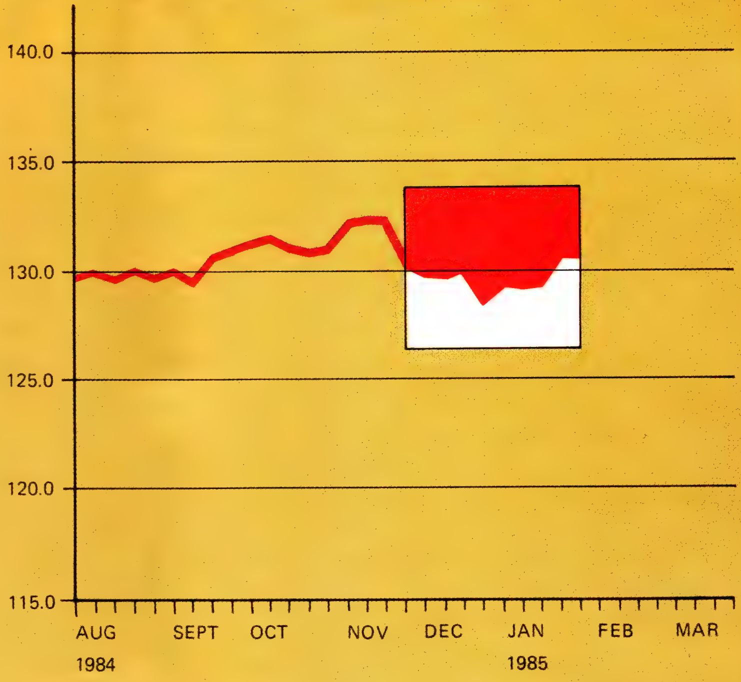


The *ElectronicsWeek* Index, a seasonally adjusted measure of the U.S. electronics industry's health, is a weighted average of various indicators. Different indicators will appear from week to week.

U.S. ELECTRONICS INDUSTRY EMPLOYMENT

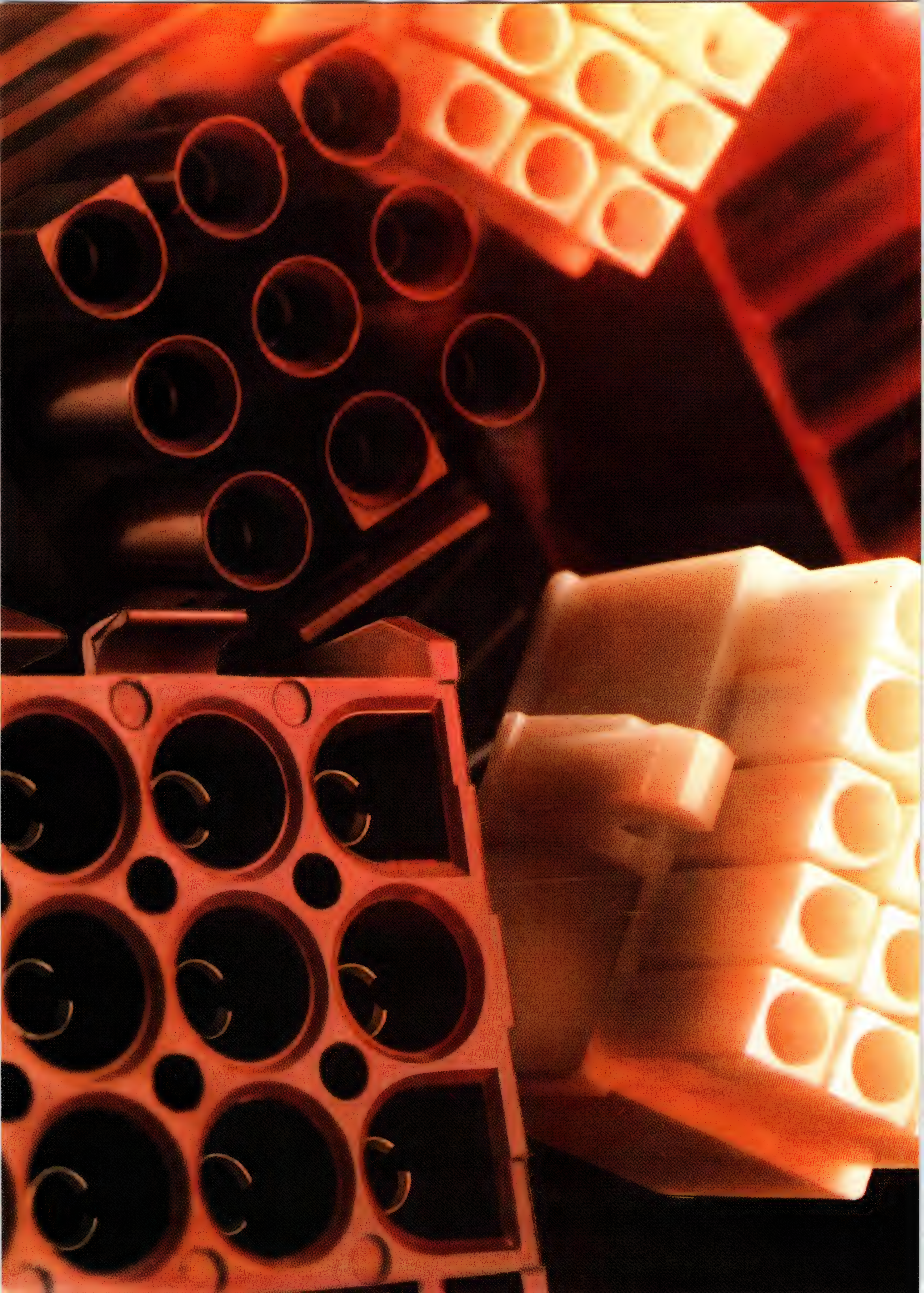
Production workers (thousands)	December 1984	November 1984	December 1983
Office and computing machines	198.0	199.8	198.3
Communications equipment	295.1	292.6	268.8
Radio and TV receiving equipment	61.8	63.0	62.9
Components	421.7	423.8	380.0

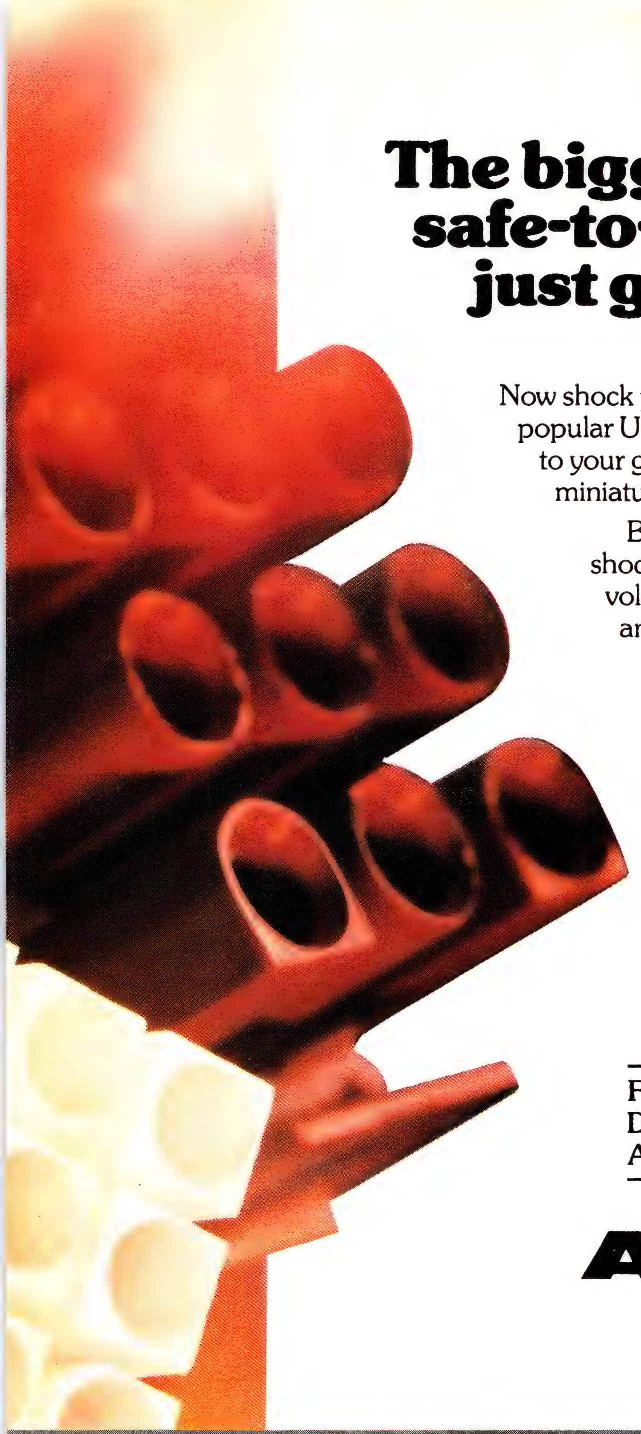
Despite December's surge in shipments of electronic equipment, employment levels throughout the industry slipped, causing a tiny dip in the *ElectronicsWeek* Index for the latest week. Production-worker employment fell almost across the board in December, the latest month for which statistics are available. The steepest declines were in the radio- and TV-equipment industry, where manufacturers cut worker ranks by nearly 2%. In an attempt to dry up the glut of semiconductors, component producers slashed their payrolls for the fourth month in a row—this time by 0.5%. In addition, employment by office and computer machinery suppliers was down 1%. Only the communications-equipment industry added new workers in the month: employment in this sector is now 10% higher than a year ago.

The latest national employment figures show that the electronics industry is not the only sector of the economy to trim its ranks. Overall unemployment in December rose to 7.1% from 7.0% the preceding month; January saw unemployment grow to 7.3%.

Still, as far as this year's economy is concerned, things are looking up. Interest rates continue to slide, knocking mortgage rates down a peg or two and stirring increased housing purchases. Consumer spending is on the rise as well. Though that's good for imports of consumer-electronics equipment, domestic manufacturers should be able to register extra sales as well.

The budget deficit remains a cloud on 1985's economic horizon. Coupled with the economy's latest signs of revival, the federal government's borrowing requirements, in competition with private investment's needs in financial markets, could put push interest rates up. And rising interest rates could then mean a slowdown in economic growth.





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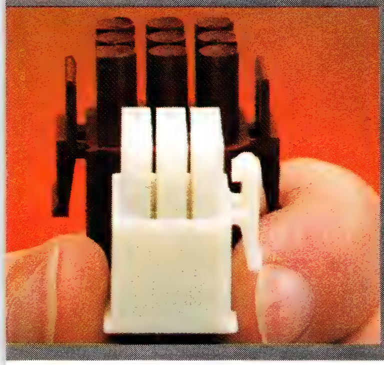

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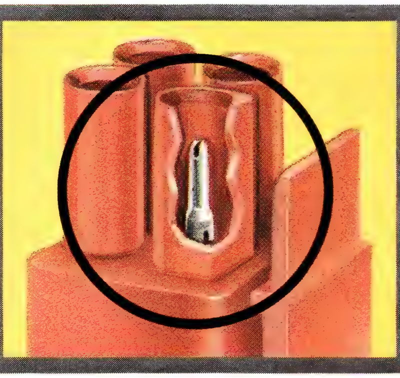
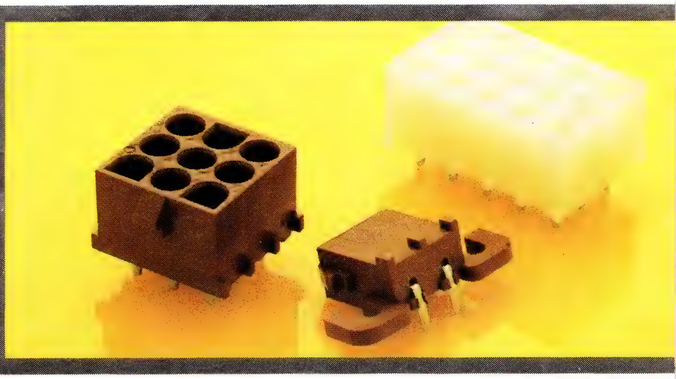


Silo design for positive polarization and contact protection.



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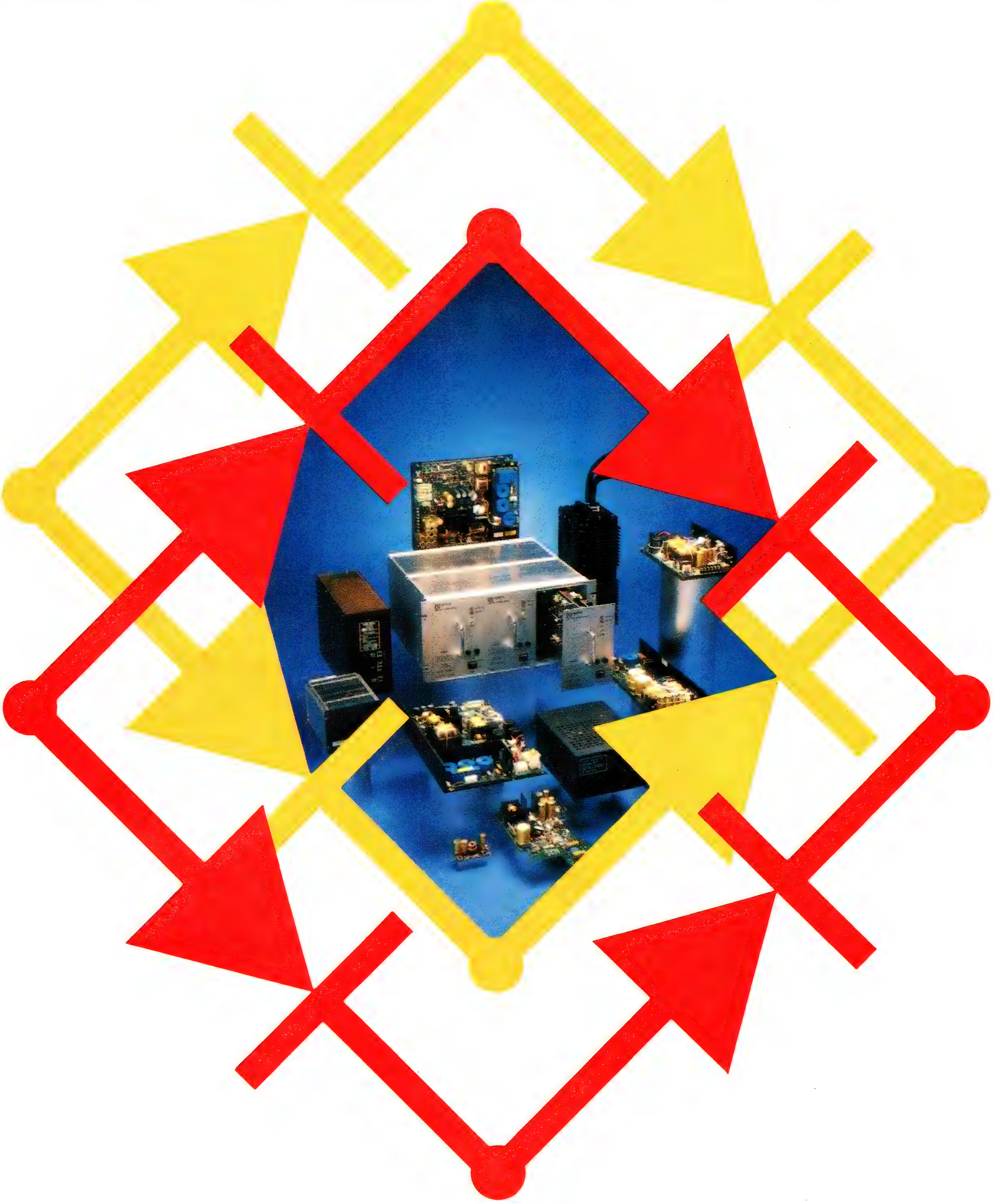

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Advanced Technologies Move Power Supplies in New Directions

Some critics of the industry say that power supplies are a commodity market where price is the main consideration. But they should look again. What they will find is a vibrant market, with countless products noted not only for their price but also for their features.

Other naysayers think every last major advance in power-supply design has been wrung out. If that be the case, then today's switching power supplies would not rival ferroresonant supplies in efficiency ratings; dc-to-dc converters would not be so small that they can be mounted directly on printed-circuit boards; and the uninterruptible power system that supplies 600 kVA would not be sitting on the floor beside the computer but rather be banished to the basement. This is but some of the progress made in the past few years.

Though power supplies are not the glamorous part of the electronics industry, they are certainly crucial—for no electronic gadget functions without a source of reliable, stable power.

Numbers reveal the power-supply market's strength. According to research done recently by Computer Products, Pompano Beach, Fla., which designs, manufactures, and markets electronic power converters for the industrial market, the worldwide market is about $8.6 billion strong and is growing at 16% a year.

About 75% of all power supplies are produced by original-equipment manufacturers for their own use. This leaves $2.2 billion for the open market, which is served by about 400 U.S. companies, none of which is dominant. The largest had 1983 sales of $92.8 million; Computer Products' sales were $37.7 million, placing it among the top five U.S. suppliers.

Much to Discuss

Numbers are not the only indication of the industry's strength, however. Late last year, the first Power Sources Conference was held in Boston, Mass. A number of power-supply makers gathered to bring potential customers up to date on the technology and to showcase new products.

Judging from the papers and products that were presented, as well as from the products introduced by companies not participating, power-supply buyers have much good news to cheer about.

It's no secret that quality sells, but only recently has quality been judged by objective criteria. To gain a competitive edge requires that components and systems be made in accordance with internationally accepted standards on quality.

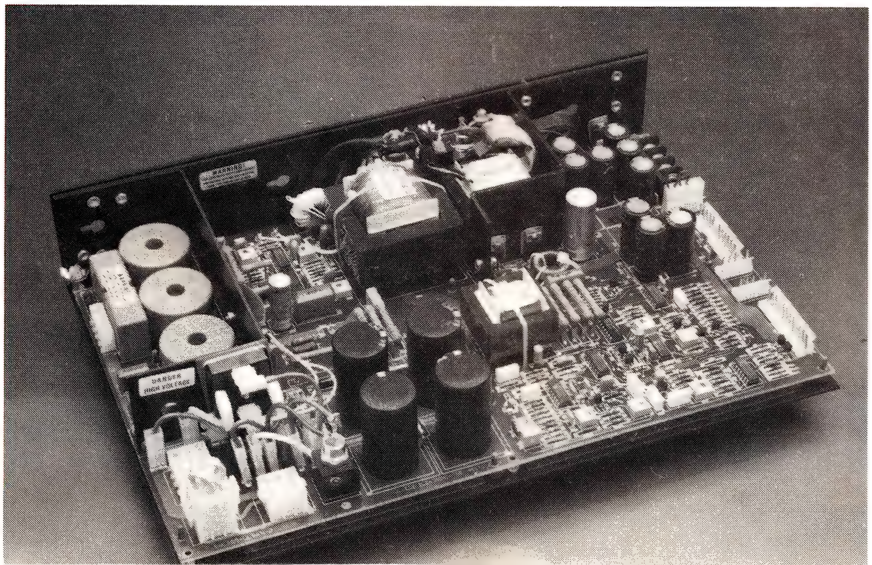
John M. Kinn, vice president of the engineering department of the Electronics Industries Association, presented a paper that described the IECQ-System, an international system used to certify the quality of electronic components. "The system holds great promise of providing manufacturers of components as well as of assemblies and systems with an effective means of producing and using components of known quality. It is a marketing and business support system capable of providing economic advantages to both buyers and sellers of electronic components and apparatus."

Trading Made Easy

The IECQ-System's objective is to facilitate international and domestic trade in electronic components by having an approved manufacturer certify that the component meets recognized and approved specifications. It provides for a national organization in each full-certifying country to ensure operation with integrity, in accordance with internationally accepted rules. Currently, there are 13 full-certifying countries: Australia, Belgium, Denmark, France, West Germany, Ireland, Israel, Japan, the Republic of Korea, Switzerland, the UK, the USSR, and the U.S. Other countries supporting the organization include the People's Republic of China, Hungary, India, Italy, Norway, the Netherlands, Poland, and Sweden.

The cover photo was provided by Ulveco Electronics Inc., of Foster City, Calif., and Avon, Conn.

The SIO 4310 open-frame switcher from Ulveco Electronics Inc. is designed for use in microprocessor-based systems for powering tape and disk drives and printers. [Circle 460]



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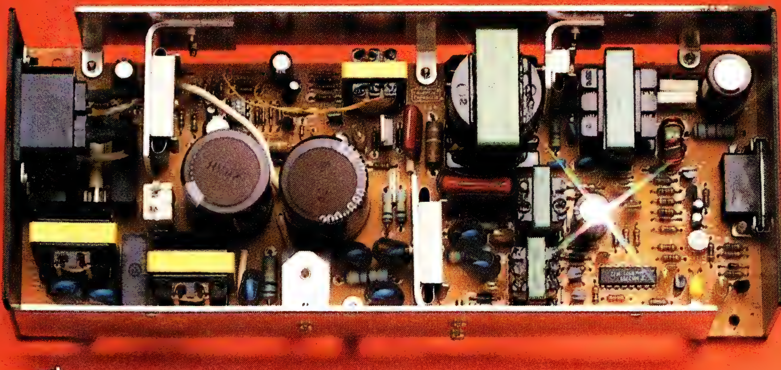

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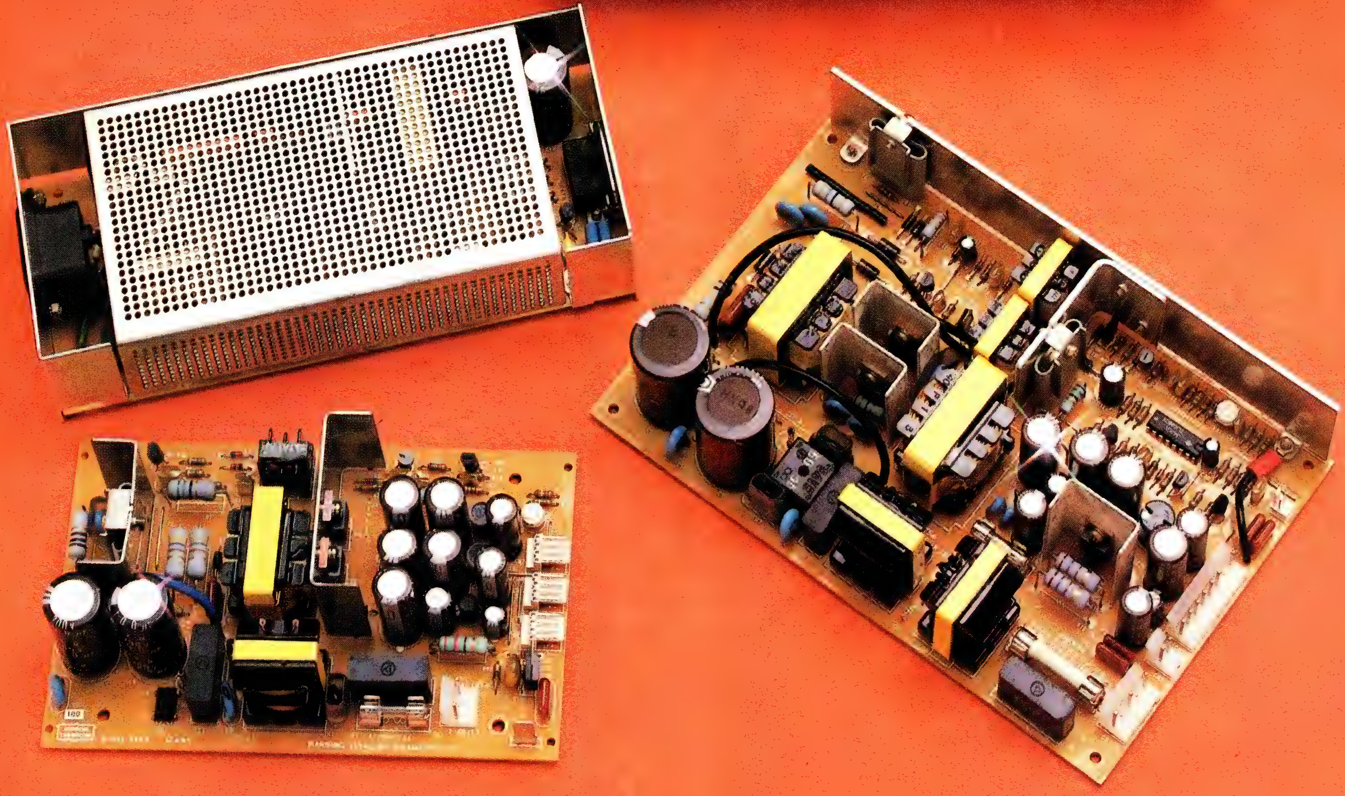

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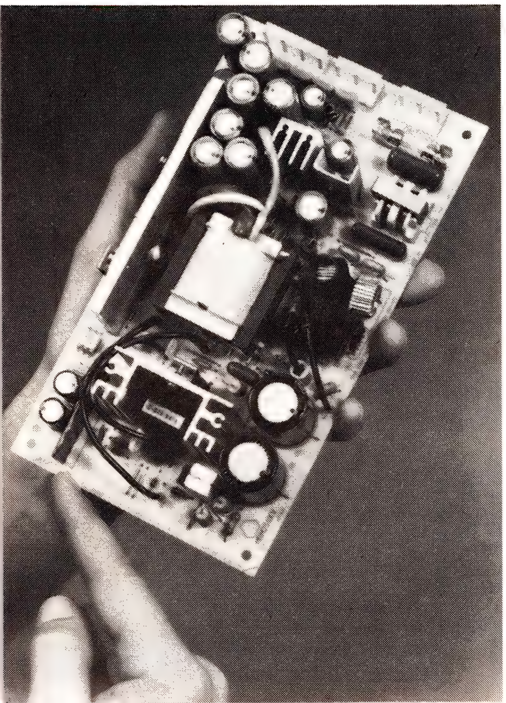
Circle 47 on reader service card

In addition to guaranteed components and systems, power-supply customers can look to higher frequencies in switching power supplies thanks to more sophisticated passive components. G.R. Love and W.W. Schroeder of the Sprague Electric Co., North Adams, Mass., described a pair of filter capacitors aimed at switch-mode power supplies.

Though designers are raising the switching frequency of supplies, standard resistors and capacitors yield power supplies with totally unacceptable ripple voltages superimposed on the desired dc. The only way to reduce the output ripple voltage is to decrease the filter impedance.

The two capacitors from Sprague do just this. For applications sensitive to both size and price and for characteristic switching frequencies of 100 kHz and less, the authors discussed an aluminum electrolytic capacitor of unusual design. Its rectangular case houses an extended-foil working element with the turns shortened to minimize parasitic inductance. It also has an ideal impedance versus frequency curve and comes in ratings from 6.3 to 250 V.

For switching frequencies between 100 and 300 kHz, a solid-tantalum device in a 16-pin dual in-line package offers less capacitance than the aluminum devices, as less is needed at the higher frequencies. But it also offers lower parasitic resistance and inductance over a wider temperature range, along with the solid-tantalum capacitor's high reliability in hostile environments. The benefit of all this, according to the authors, will be more-compact power supplies that switch at higher frequencies.



This 60-W four-output supply from Kepco Inc. has built-in electromagnetic- interference filtering, letting it operate below the limits of FCC Class B requirements. [Circle 462]

Among the attendees at the Power Sources Conference was Boschert Inc., of Sunnyvale, Calif. Boschert was one of the first companies to manufacture commercial switching power supplies, starting in 1974 with a 150-W switcher to replace a linear supply in a printer. Boschert's new XL160 and XL200 series use a new approach to the two-stage converter, improving performance. It provides, in addition to lower costs, greater power density (measured in watts per cubic inch), more available power on most outputs, and higher peak-power ratings.

First Things First

The first stage is a buck converter that simply regulates a constant output voltage regardless of output loading. The regulated primary has no secondary-to-primary feedback, eliminating most cross-regulation effects and the optoisolator as well as simplifying safety considerations.

A local feedback loop, called the adder regulator, controls the main 5-V output. The adder regulator on the main output will not cause cross-regulation problems between the main output and auxiliary outputs as main output current is changed, because it does not affect power-transformer primary voltage.

The two-level feedback-loop approach also eliminates initial voltage error. The auxiliaries are first set to their proper output voltage by adjustment of the buck-converter output voltage. (The auxiliary outputs are otherwise unregulated.) The +5-V output is then set with its own local regulator.

At times, users may want supplies that accept a wide range of inputs. Such supplies can be used where severe transients are present, such as in mobile and airborne applications. Furthermore, a single such supply can work with different batteries, such as 24, 28, 48, or 60 V, in industrial, telecommunications, mobile, or military applications.

A paper presented by an engineer from Melcher Electronics Equipments Inc. described such a versatile switching power supply. Melcher engineers worked 10 man years to develop a family of step-down switchers. The switcher's exceptionally wide input-voltage range comes from varying the duty cycle from nearly zero to nearly 100%. The duty cycle is determined by the applied input voltage, to which it is inversely proportional. When the input voltage is high, the on cycle is very short and vice versa.

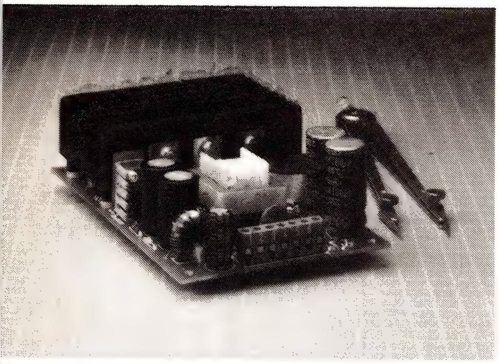
In addition to a wide input range, the switchers boast efficiencies as high as 95%. This efficiency level is gained by the use of power FETs with very low on-resistance ratings, by overdesigning the freewheeling diode with adapted snubber networks, and by use of magnetic materials with low losses. For its PSR/NSR supplies, Melcher claims a mean time before failure of 100,000 to 400,000 hours at 40°C for industrial components.

Smaller, Lighter

The power-supply technology making the most waves in the industry is switch-mode regulation, or switching power supplies. Switching power supplies, which convert the 60-cycle line frequency into much higher frequencies through electronic switching techniques, have come into prominence in the past 10 years.

Because of this higher frequency, the power transformer and other components are smaller and lighter than those used in linear power supplies. In addition, switching power supplies operate with much greater efficiency; therefore, they generate less heat than the older linear supplies.

The switching power supply accepts ac inputs. The dc-to-dc converter, a variation on the switching supply, also operates at high frequencies to convert a dc voltage into a filtered, regulated



This 40-W dc-to-dc converter from Intronics Inc. employs MOS FET technology in its design and has a switching frequency of 100 kHz. [Circle 463]

dc voltage. A dc-to-dc converter is used to transform the dc voltage from a battery into another voltage or to transform the dc output of a power supply into a different voltage for powering electronic equipment.

Some of the small dc-to-dc converters are just larger than a dual in-line package and mount directly on a printed-circuit board. One such converter comes from Reliability Inc., Houston, which began in 1967 as an independent semiconductor laboratory. Reliability is best known for its burn-in conditioning, a testing process that the company helped pioneer. In 1972, Reliability designers saw that integrated-circuit users needed a compact power source to replace large power supplies. The new product was called the V-PAC; now the company's line produces 1 to 10 W of output power.

One of its newest supplies is the VA/VP series of 1-W semiregulated dc-to-dc converters, which operate from an input of 5 or 12 V dc. They make available at board level a wide range of isolated output voltages, either single or dual. The converters are encapsulated and operate over their full specified temperature range without derating or the need for heat sinks.

Other firms making dc-to-dc converters are Calex Corp., in Pleasant Hill, Calif., and Rifa, in Greenwich, Conn.

Bridging the gap between encapsulated dc-to-dc converters and the larger open- or closed-frame switchers are a line of 40-W dc-to-dc

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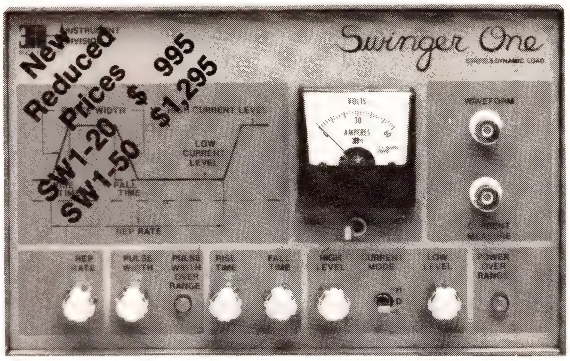

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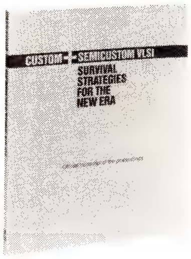

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converters from Intronics Inc., Newton, Mass. The DCC line was designed to fill a void in the 40-W dc-to-dc converter market by providing wide input ranges, small size, pc-board mounting flexibility, and high efficiency.

The units put out 40 W of power on an open card that can be stacked or rack mounted; its small size—3.5 by 5.5 by 1.35 in.—gives the user a number of mounting options. Single-, dual-, and triple-output configurations are available in combinations of 5, 12, 15, ±12, and ±15 V dc.

Small is not only the province of dc-to-dc converters. Open-frame switching supplies are also shrinking as designers apply new technologies—surface mounting, in particular. Todd Products Corp., Brentwood, N.Y., has a supply it claims is 20% smaller than the nearest competitive unit.

Its new 150-W multiple-output power-supply line has been designated the MCT series. The company says that advanced surface-mounting technology, in which chip components replace traditional resistors, condensors, and other components, contributes to this high power density in a frame that measures 9 by 5 by 2.5 in. All four units in the line have +5 V at 25 A and +12 V at 5 A outputs.

Within the next month, Todd Products will introduce a new series: the MFT series delivers 200 W of multiple-output power in the same-size package as the MCT series. A 400-W entry with slightly larger dimensions will follow.

Other techniques are being used to shrink the size of switchers as well. The Lambda Electronics Division of Veeco Instruments Inc. offers the LR series, which provides high reliability with half the number of components in a smaller, more compact package. Lambda is the world's largest manufacturer of standard switching and linear electronic power supplies for mainframe computers, computer peripherals, telecommunications equipment, automatic test equipment, industrial process controls, industrial robots, medical equipment, military and aerospace applications, and electronic laboratories.

Clean Design

For the LR series, Lambda uses a new circuit layout for simple and reliable operation with high thermal and electrical efficiency. A custom integrated control circuit replaces 40 discrete components. This reduced parts count results in a high mean time between failures. The series uses highly reliable power MOS FETs for fast and efficient switching with minimal control and drive circuitry. An integral filter to block electromagnetic interference is standard on all units.

The line's 16 models provide regulated adjustable dc voltages of 5 to 48 V at current ratings of up to 40 A for the lowest voltage and up to 5.8 A for the highest.

A Taiwanese company is very aggressively marketing a line of power supplies through its local office in Norcross, Ga. Teapo Electric Corp. provides switching power supplies for use in personal computers, disk-drive systems, monochrome and color cathode-ray-tube terminals, and video game machines. All are multiple-output supplies that provide ±5 and ±12 V, with power ratings from 40 to 170 W.

Teapo entered the market for switching power supplies in 1979 by selling to game-machine manufacturers. Its success with that segment propelled it into the rapidly expanding computer market. Since the second half of 1981, Teapo has designed and manufactured custom units exclusively for several major companies in the U.S. Its present production stands at 5,000 to 8,000 units per month. But when it moves into its new facility, sometime this spring, production should rise to 10,000 to 20,000 units a month.

Recent Federal Communications Commission regulations make radiated and conducted interference important considerations in selecting switching power supplies. Computer Products' Compower Division, San Jose, Calif., has a new series of 150-W switchers that have five outputs and feature very low electromagnetic radiation.

Compower's switchers meet FCC class A and B radiation specifications

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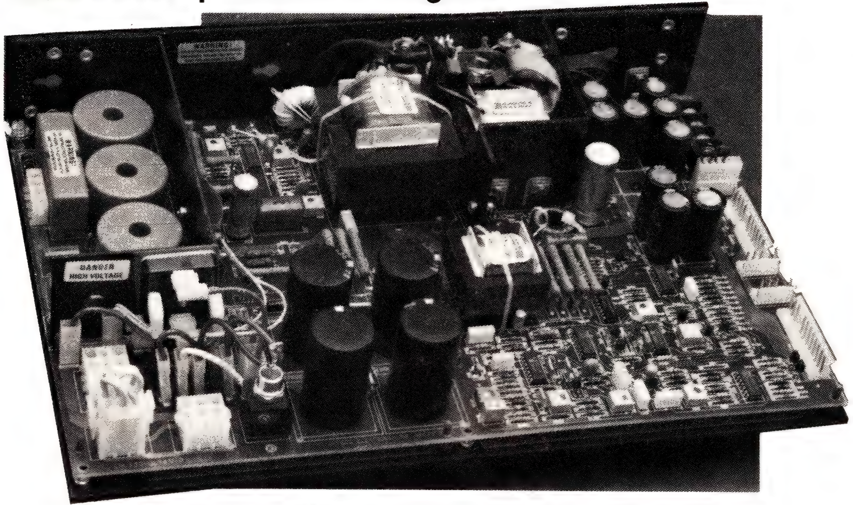

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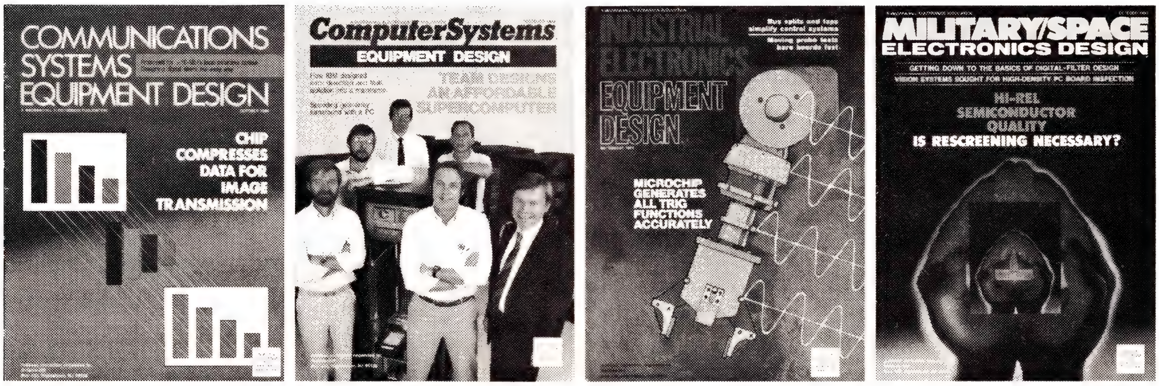
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without a cover or shield. In addition, an input line filter reduces conducted interference to a very low value, well within both FCC and VDE requirements.

Compower's 80008 series consists of four models, each with five outputs. Outputs can vary for different needs. For example, one output is +12 V dc at 2 A, or +24 V dc at 2 A with a linear regulator, or +24 V at 2 A with high peak-current capability for disk drives.

Computer Products competes in all segments of the power-supply industry through its other divisions: Power Products Division, Pompano Beach, Fla.; Stevens-Arnold Division, South Boston, Mass.; and for overseas markets, Power Products Ltd., in the Republic of Ireland, and Computer Products Caribe Ltd., in Antigua, West Indies.

From overseas

Another foreign company that sees the U.S. as fertile soil for growing a power-supply business is Ulveco Inc., one of a dozen industrial electronics companies assembled in a newly formed group owned by the Swedish conglomerate Procordia. Ulveco operates from Foster City, Calif., and Avon, Conn. Its switching power supplies are designed to comply with virtually every international safety and rfi standard.

Requirements for safety and radio-frequency interference differ considerably among the world's regulatory agencies, creating product design obstacles for many manufacturers. During the past decade, however, Ulveco has developed the technological expertise to clear these hurdles. Its supplies, which range in output from 200 to 1,000 W, meet standards established by the VDE, the FCC, Underwriters Laboratories, the International Electro-technical Commission, the British Post Office, the European Computer Manufacturers Association, and the Canadian Standards Association.

Other companies in the consortium manufacture toroidal power transformers (formerly designed and marketed by Transduktor Inc., Greenwich, Conn.), line conditioners, and uninterruptible power supplies ranging from 500 VA to 30 kVA.

Meeting worldwide standards is the method many domestic power-supply makers are using to expand their markets. Power-One Inc., in Camarillo, Calif., Deltron Inc., in North Wales, Pa., and Kepco Inc., in Flushing, N.Y., all make supplies that meet international standards.

Kepco, established in 1946 to produce educational materials and instruments, has grown into one of the world's largest manufacturers of standard, catalogued power supplies. Its many achievements include its pioneering of the operational power supply and its programmable unipolar and bipolar units.

The company, which holds over 80 patents in the power-supply field, competes in the laboratory, linear, and ferroresonant markets as well as in the switching-supply market. Its latest product is a frameless 60-W switcher that meets the highest international standards.

The MRM 250KV is a pc-card-style four-output flyback switcher that carries a SELV (Safety Extra Low Voltage) rating according to the spacing and hi-pot requirements of IEC 380 and VDE 0806. It has been certified by TUV Rheinland. The MRM 250KV's built-in EMI filtering is below FCC Class B limits; the switcher meets both UL 478 and CSA 22.2-154 standards.

Inputs are 115/230 V ac and are jumper selectable. Proprietary hybrid circuits reduce parts count, increase mean time between failures, and lower cost. The supply's four outputs are +5 V at 6 A, +12 V at 3 A, −12 V at 1 A, and −5 V at 0.5 A.

Deltron's offering in world-class supplies includes single-, dual-, and triple-output linear models. The units comply with UL, VDE, CSA, and IEC safety and FCC and VDE emission regulations. Other world-class models include Deltron's VQ series of single-output linear supplies, selections from its single-output Q series and dual- and triple-output CP series.

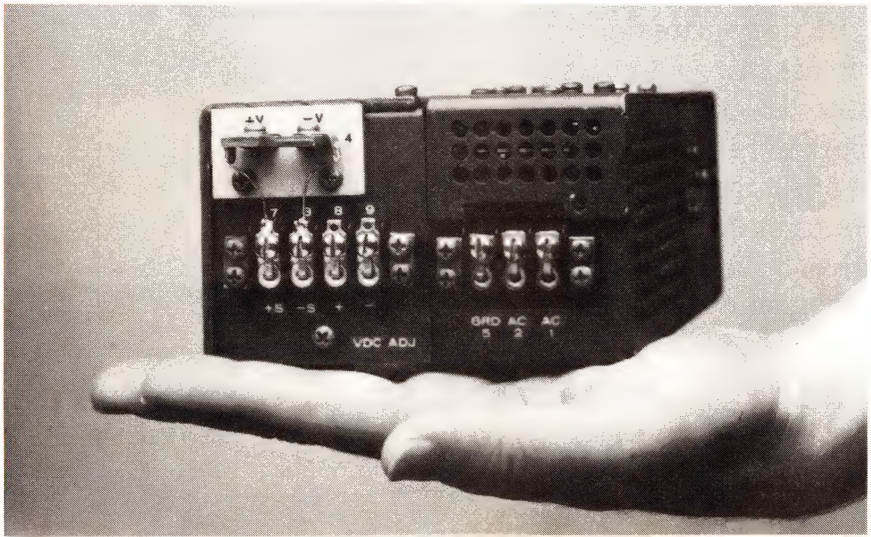
All models have remote sensing, overload and short-circuit protection, and reverse-voltage protection. Five-volt single-output units have a built-in fixed-crowbar overvoltage protector. Multiple-output supplies have a built-in fixed crowbar on the first output when its voltage is specified as 5 V only. Wattages range from 15 to 250 W.

Military Supplies

Powercube Corp., a Billerica, Mass., subsidiary of Unitrode Corp., has produced a military power supply that meets the U.S. Navy's new Navmat P4855-1 design guidelines. Based on a current-mode feed-forward converter topology, the Icecube is touted as a standard product line for military applications using the UC-1846J current-mode control IC.

Available in ac-to-dc and dc-to-dc versions, the Icecube exhibits efficiencies as high as 90%. Its minimum efficiencies stand at 70% over the entire military temperature range of −55°C to +100°C with no derating. □

Guaranteed for five years, this switcher from Lambda Electronics incorporates a custom control circuit that replaces 40 discrete components. [Circle 461]



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Milan, Italy

Paolo Viti likes to tell the story of the time he put Ing. C. Olivetti & C. SpA's logo on a Brother typewriter and then criticized the appearance of the counterfeit machine in front of one of the Italian company's principal design consultants. "Brother had copied the design of our ET line so closely that the consultant couldn't tell the difference and tried to defend it," chuckles Viti, the director of Olivetti's Corporate Design Division.

That Brother should have used the Olivetti machine as a model comes as no real surprise. The external design of Olivetti's electronic typewriter line is without doubt the most imitated in the typewriter industry. And the success of that design is far from being a fluke. As people in and out of the industry know, over the years Olivetti has piled up a long list of design honors. But even beyond those distinctions, the company has had a number of its products included in the permanent collections of art museums, including New York's prestigious Museum of Modern Art.

Nonetheless, design at Olivetti amounts to far more than an aesthetic exercise. Viti points out that within the corporation his design division is equal in status with Olivetti's major operating divisions. Therefore, the division can muster more clout than can its less influential counterparts at competing companies.

One manifestation of this privileged position is that members of his staff, in addition to designing, are involved in the company's research, product development, and strategic planning. This degree of involvement enables them to leave their mark on a great deal more than the physical appearance of Olivetti products.

"Basically, our role is to represent the outside world within Olivetti," explains Viti. "We try to find a balance between ergonomics and aesthetics, so that we can guide the company into offering products that are as natural to use as they can possibly be. But more generally, we make a point of keeping very much in touch with the public and its current needs. And that puts us in an excellent position to collect the information that Olivetti needs to know about future needs."

Helping clients. Part of public contact means helping prospective clients with their planning, and Viti claims some credit for the company's success in two important banking-automation contracts—one each in Denmark and the UK.

"We make an all-out effort to find a customer the best possible solution," Viti comments about the planning help given to clients. "The real advantage for the client is that it gives him a contact with someone inside the company whose interest is not inherently commercial. I think we were probably the first to take this approach, but it is becoming more and more common throughout the industry." –**Robert T. Gallagher**

RCA'S SHROYER TO COORDINATE VLSI PARTNERSHIP WITH SHARP

Somerville, N.J.

Shuttling between Japan and RCA Corp.'s Solid State Division here, Jon A. Shroyer heads the RCA team negotiating a joint-venture agreement with Sharp Electronics Corp. to design and manufacture CMOS very large-scale integrated circuits in the U.S. He calls the deal a true partnership agreement in which both companies will benefit from the combined resources.

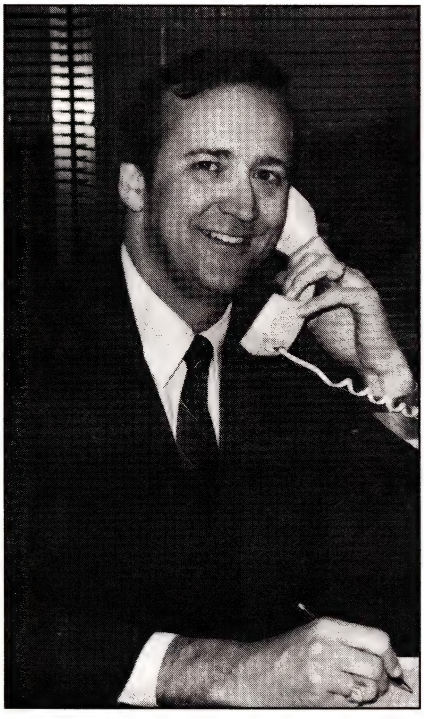
"In the next two years, we expect to make major progress through our relationship with Sharp," says Shroyer, RCA's division vice president for LSI Products and Technology Development. He adds that the division hopes to be competitive with the world leaders in VLSI by 1988.

Together, RCA and Sharp will possess the resources of a $1 billion integrated-circuit company.

By restricting the IC agreement to CMOS technology only, Shroyer says the partners want to make it clear that they "are not trying to be everything to everybody." Combining RCA's strength in CMOS with the proven Japanese approach to processing and particle control will cut wafer defects and thus obtain higher yields, he explains.

Counting particles. Most U.S. chip makers have concentrated on technological innovation, Shroyer observes, but RCA wants to place more emphasis on adopting these Japanese manufacturing techniques at every level. These processing techniques "allow you to measure particles on the wafer itself." Because defects are usually related to particles, the ability to measure them in the 0.1-to-0.2-μm range could help RCA achieve average particle counts of 10 to 25 per wafer—a range comparable to that of Japanese manufacturers.

Shroyer, 41, has nearly two decades of experience in the IC industry. After earning a BSEE from the University of Illinois, Champaign-Urbana, the Oakwood, Ill., native joined Motorola Inc. in Phoenix, in 1965. He worked there five years while doing graduate engineering work at Arizona State University. Shroyer spent eight years with Texas Instruments Inc., three years with Mostek Corp., and worked for Data General Corp. for two years before joining RCA Solid State in 1982.



Sharp dealer. Jon A. Shroyer is helping RCA collaborate with Sharp to equal the resources of a billion-dollar IC company.

One market that RCA hopes to crack—using Japanese particle-control methods—is memories. Ticking off the names of such memory makers as Hitachi, Toshiba, Motorola, Intel, and others, Shroyer concedes that "ROMs are not exactly a business where you don't have any competition." RCA now offers 128- and 256-K read-only memories with 2.5- to 3-μm technology; the firm has plans for 0.5- and 1-Mb memories by early 1986. –**George Leopold**

NONCONFORMIST ENGINEER PLANS TO SHAKE UP INDUSTRIAL VISION FIELD

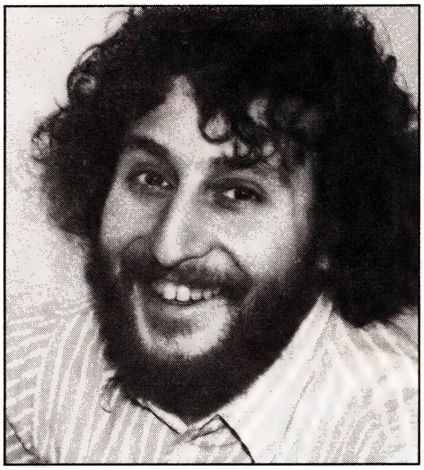
Peabody, Mass.

It's a sign of the sober 1980s that a young Emmy-award-winning engineer from a rock studio could move from California to Massachusetts to design industrial vision systems—and be enthusiastic about the switch. "The potential for breaking ground here is enormous," says Shepard Siegel, 25, a senior engineer at Datacube Inc. In his new work, he sees "spinoff potential for broadcast" and the potential to become extremely wealthy.

Mixing with the stars. Siegel concedes that industrial vision isn't as sexy as his work at Ampex Corp. just before he came East. There he was a member of the team that won an Emmy for developing the Ampex Digital Optics unit for special effects, which since has been used to produce pieces such as the opening segment of "Saturday Night Live."

Before going to Ampex, Siegel was chief engineer at Bearsville Sound studio near Woodstock, N.Y., working with Joe Cocker, Tina Turner, Keith Richards, and other pop stars. This makes an impressive resume for someone who dropped out of the Rochester Institute of Technology in his third year to design analog filters for the recording studio.

"Working at Bearsville was the great thrill of my life to that time," says Siegel, who was born in Brooklyn and whose early years were divided between Manhattan and upstate New York. "I always wanted to be an engineer in a studio—to build equipment and then use it."



New horizons. After working with rock stars, Shepard Siegel has taken his talents to the machine vision industry.

He didn't regret leaving school until he began working in video. "When I first left Bearsville, I felt perfectly adequate. But after I got to Ampex, I wished I had a lot more math. I learned how important math is to digital signal processing."

Siegel's first assignment at Ampex was handling technical support for the Ampex Digital Optics project. But he takes the most pride in having helped design the unit for a "traveling" matte, which allows a partial image to move on a different background.

Open field. At Datacube, Siegel leads a team that is developing a line of modular machine-vision products for the VMEbus (see related story, p. 77). "The industrial vision market is clunky," says Siegel, whose engineering philosophy is best described as functional nonconformity. "The big bulk of the industry has not been treated to the kind of hardware I can conceive of building." Designing better hardware "will involve understanding and exploiting nonlinear filters to aid in describing the structure of an image. The new school of nonlinear digital signal processing is totally open." –**Craig D. Rose**

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GERMAN STARTUP'S SUCCESS SURPRISES EUROPEANS

Ottobrunn, West Germany

Force Computers Inc. is the kind of success story that catches many Europeans off guard because they so seldom see it happen: two managers break away from a large company to set up their own firm and make a go of it with innovative products.

That, briefly, is the tale of Sven Behrendt and Max-Eberhardt Lösel. The two former top managers at Motorola Inc.'s West German operations founded Force Computers in Santa Clara, Calif., in October 1981, then set up the affiliate Force Computers GmbH in this Munich suburb in January of the following year. Their products: 16- and 32-bit VMEbus 68000-based computer boards.

In 1982, after the first full year of operations, Force Computers chalked up sales of $1 million. Business jumped fourfold in 1983 and took another quantum leap to $13 million last year. "We are aiming at $25 million to $30 million this year," says Behrendt, president and 60% owner of the company. (Lösel owns 20% and employees the remaining 20%.) "In 1988, we may hit $125 million."

Aboard the VMEbus. "We are concentrating on standard products and are also filling market gaps," says Force vice president Max-Eberhardt Lösel.

By Silicon Valley standards, such sales hikes might not be unusual for a company starting from scratch. But what is not so common is that Force turned a profit during the second year of operations. In addition, the firm began without venture funding—Behrendt and Lösel themselves put up the starting capital.

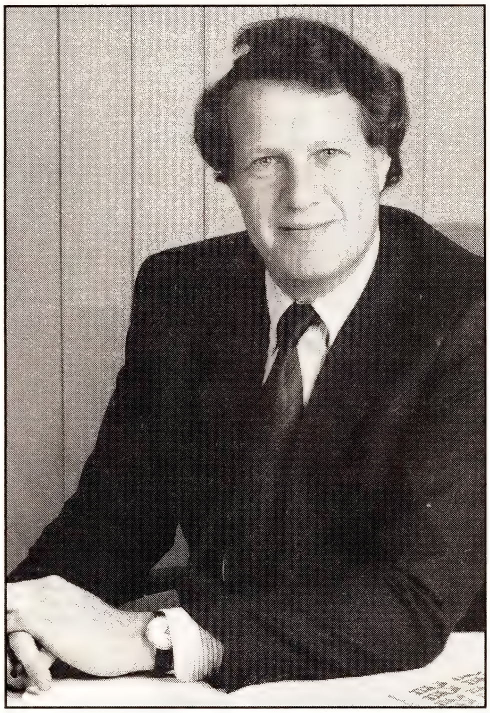
Trying harder. Of note, too, is the position that Force has attained in such a short time in the VMEbus-board market. "After just two years, we became No. 2 in that market," trailing only Motorola, Behrendt claims. This is all the more significant because Force, unlike its competitors, which include Motorola, N.V. Philips, and Mostek, is not a semiconductor maker.

Behrendt attributes Force's success partly to its management's combination of familiarity with the semiconductor business and expertise in systems design. It is Behrendt—born in Berlin, educated in Israel—who, with nearly 20 years of management experience acquired at firms such as Texas Instruments, Fairchild, RCA, and Motorola, has brought to the company a good feel for the market and savvy in parts purchasing.

It was Lösel, vice president in charge of research and development, who supplied the systems-design know-how. In fact, while working at Motorola as microsystems operations manager, he became one of the originators of the VMEbus. Force's combination of business and engineering smarts, industry observers say, gives the company an edge over most of its competitors. "For semiconductor firms, a computer-board activity is merely an appendix to their normal operations," Behrendt maintains.

Squeeze play. Another factor in Force's success formula is the "excellent price-to-performance ratio of our products," the company says. In parts-purchasing negotiations, the firm carries the bidding process to what Behrendt calls the "threshold of pain." This "enables us to squeeze from producers the most favorable prices for our parts," he says.

These factors have helped the company grow faster than the market itself. Force's share of the worldwide VMEbus-board market, which came to between $50 million and $60 million last year, is now between 20% and 25%. At this point, the



Big enough share. "Our goal is to remain No. 2 in the world market for VMEbus computer boards," says Force president Sven Behrendt.

three-year old firm has lined up between 400 and 450 customers for its products and is acquiring new ones at a rate of 25 to 30 a month. "Our goal is to keep the No. 2 position in sales," Behrendt declares.

In this effort, Force is guided by a two-part marketing philosophy. As Lösel explains it, one part is to concentrate on standard boards, which "ensures volume business." The other is to go after market niches with specialized boards for industrial applications in, for example, the aerospace, process-control, and factory automation fields. "We are staying out of the personal computer and consumer sectors," he points out.

Growing market. Force Computers operates in a market that is expanding by leaps and bounds. According to company estimates, worldwide sales of 16- and 32-bit boards will go from $650 million in 1984 to $880 million this year and then shoot up to $1.2 billion in 1986. In 1988, Force believes, sales should reach about $2.2 billion.

In this market, VMEbus 16- and 32-bit boards will account for just 15%, or $130 million, this year, with Q-bus- and Multibus-based boards by far the market leaders. But VMEbus versions will catch up fast, Force believes. It is estimated that in 1988 sales of VMEbus boards will hit $660 million, which works out to 30% of the total. By then, VMEbus boards should have pulled even with Multibus I and II versions.

Although Force's headquarters is in Los Gatos, Calif., the German affiliate here is far bigger. The German facility also accounted for the bulk of Force's 1984 sales—62%. The workforce in Germany now stands at 35 and may go to 55 this year.

The reason for the European predominance is that the VMEbus was developed in Europe and got a fast start there. But meanwhile, the U.S. has caught on—so much so that for this year, Behrendt sees Force's sales divided up about evenly between the two areas. For 1986, the ratio of Force's sales should be roughly 60% to 40% in favor of the U.S.

The result is that Force will open design, test, and application-support activities at its Los Gatos location in April. As is the case in Germany, board assembly work will be farmed out to subcontractors. –**John Gosch**

MEDICOMP HAS REASON TO SMILE OVER VALENTINE'S DAY DELIVERY

Fairfax, Va.

Medicomp of Virginia Inc. couldn't have asked for a better Valentine's Day present. After almost seven years of development, the firm's product—a medical-records system—was installed on Feb. 14 in its first customer site, the Cleveland Clinic Foundation in Ohio.

Happy. "The inquiries have been pouring in," says Medicomp president Peter Goltra about his firm's medical-records system.

Medicomp's system—also called Medicomp—combines the heuristic abilities of artificial intelligence with a knowledge base of medical expertise [*ElectronicsWeek*, Feb. 4, 1985, p. 59]. It incorporates a relational data base to produce a computerized medical-assistance tool that runs on an IBM Corp. Series/1 computer. The data base covers over 3,000 diseases, 1,000 symptoms, and 1,000 medical tests from internal medicine.

The system provides the expertise of top physicians from various medical specialties. Medicomp, says president Peter Goltra, used the skills of medical specialists from such hospitals as the New York Hospital/Cornell Medical Center, Memorial Sloan-Kettering Cancer Center, Walter Reed Army Hospital, and the Hospital for Special Surgery.

The system also provides a computerized method of charting, filing, and updating patients' medical records. Medicomp uses its relational data base and knowledge base to create a differential diagnosis based on a patient's medical history.

When officials of the Cleveland Clinic saw a demonstration of Medicomp's system, they were impressed by its expertise. They tried out the system by entering data from a particularly baffling case—one of infectious endocarditis (infection of the heart valves)—that had stymied their staff. Medicomp's system diagnosed the disease rapidly, accurately, and with the limited medical history given. As a result, the hospital ordered the $55,000 system.

Not only did the sale give Medicomp its first installation in the field. It also provided the company with something it hadn't yet had: revenues. Started in the summer of 1977, Medicomp has invested more than $1 million in the project. Goltra and his two partners used their own money and bank loans to fund the project. "There is no imminent competition in this field," explains Goltra. "We should break even sometime in late 1987."

Since September of 1983, medical clinics, practitioners, and other interested parties have been able to tap into the Medicomp system through an on-line telephone hookup for free. To date, 75 users have taken advantage of the setup and now query Medicomp's system.

Desirable to doctors. When physicians and clinics realize how helpful the system can be to their practices, they will want their own systems, the executive believes. "It's not practical to be hooked up to the service for eight hours a day over the phone," he says, adding if a clinic owned its own system, intensive use "would pay for itself in no time." A group of practices can also band together and purchase one system and have completely separate records.

Medicomp's future looks promising. According to a survey conducted by the American Medical Association, 20% of U.S. medical practices now have some form of computer hardware. "The inquiries have been pouring in concerning the system," a smiling Goltra says. –**Michael Rand**

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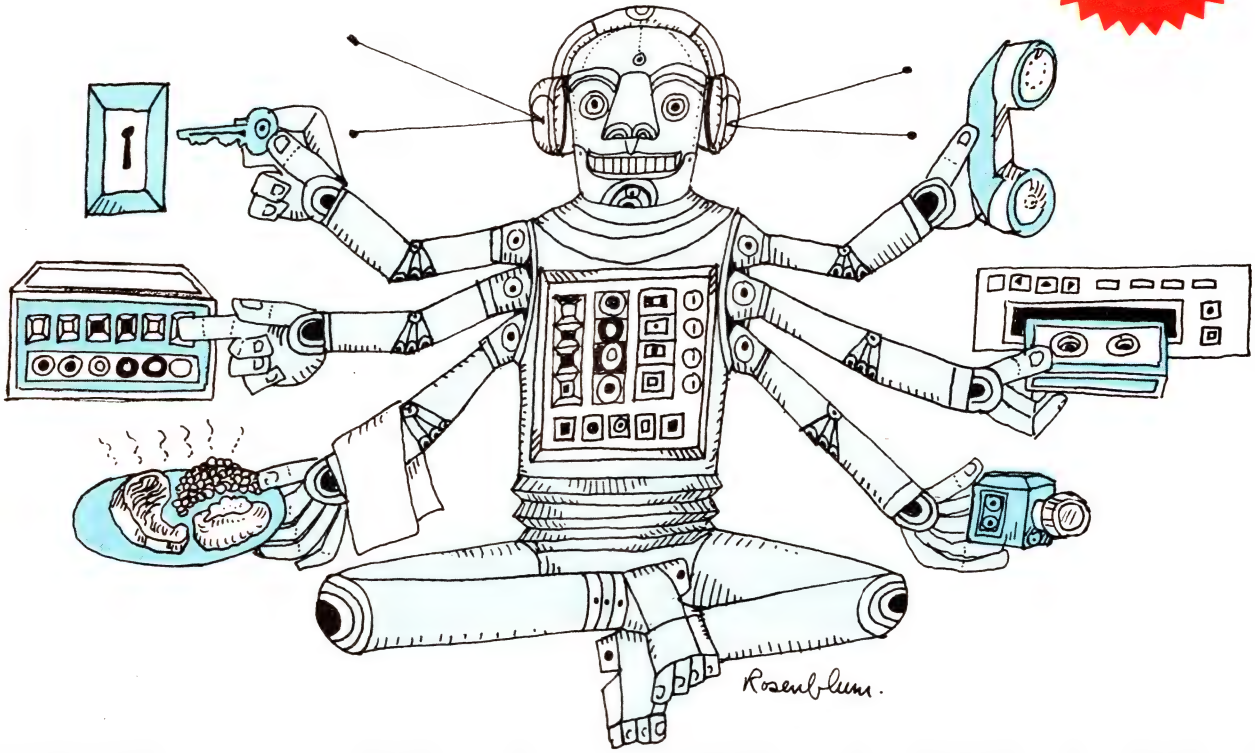


CONSUMER GAMBLE

Manufacturers are again introducing new products, but only if buyers have already shown their interest

☐ *by David M. Weber*

With manufacturers of consumer products more conscious of the bottom line than ever, they are nevertheless gambling on products based on technologies that up to now have been exciting only to insiders. At the same time, companies are banking on the novelty appeal of those products, including flat-screen television, wristwatch displays, and speech synthesis and recognition. Eventually, they expect widespread consumer acceptance, but their immediate goals are more modest.

Judging from the recent Winter Consumer Electronics Show in Las Vegas, one product whose time is coming is flat-panel TV (usually defined as being no thicker than 1 or 2 in. and distinct from projection TV, which has a flat display but a large tuner section). No exact figures yet exist for how many flat-panel sets have been carried home by consumers because the product is still too new. But the attention it commanded at the WCES indicates a high level of consumer interest.

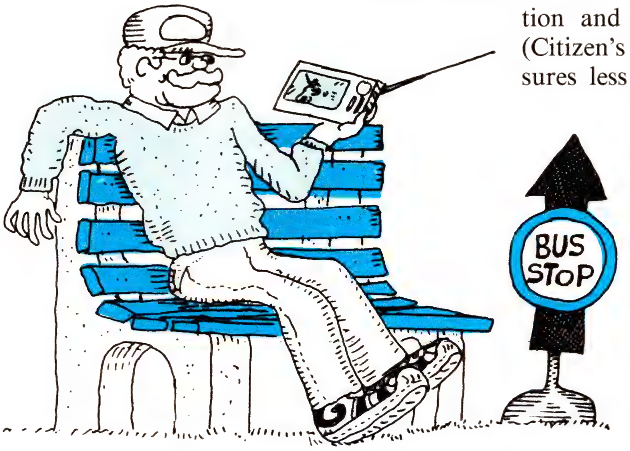
Jerry Astor, vice president of the Consumer Electronics Division of Hattori-Seiko Co. of America, estimates that 600,000 TVs with screens under 4 in. were sold in 1984. He expects growth in the neighborhood of 30% in

1985. "The market will explode," says Astor. "This isn't propaganda. Consider the popularity of soap operas. Everyone wants a TV that they can carry around with them. The only issue is price."

Currently, flat-panel sets range in price from about $100 for a basic 2-in. black and white unit to $500 for a high-end color set of the same size. Although affordable, they are not cheap—especially when a consumer can purchase a high-end conventional color TV for the same price.

David Kawakami, merchandising manager for Sony Corp.'s TV Marketing Group, agrees with Astor's analysis. In addition, he predicts that "no flat-screen TV [including the Sony Watchman] will gain wide popularity unless the price falls dramatically."

Sony uses a conventional black and white cathode-ray tube (color is not yet available) for its flat-screen set, with the deflection yoke for the electron gun mounted parallel to it. Nevertheless, the basis of most flat-panel TV is a modification of the liquid-crystal-display technology that has been used in digital watches since light-emitting diodes were phased out in the late 1970s.



Those same companies making watches are also the major producers of LCD TV. With TV, however, the LCD surface must be considerably brighter, more detailed, and more precisely controlled than a watch face.

Citizen Watch Co. markets its 50TA black and white and 60TA color TV series adaptable to all video-monitor and display applications using only National Television System Committee signal input. "No new signal-processing technology is required," claims Shigeru Morokawa, research and development manager at Citizen's technical research lab in Tokyo. But for television-size LCDs—Morokawa considers up to 12 in. currently feasible—"we have to develop new approaches to make sure that the signal is translated into the kind of picture that people can stand to watch."

Ancillary features

For smaller TVs, Morokawa sees the market being driven not only by the technology for the display's quality but also by certain ancillary features. These include direct video inputs to video cameras and video cassette recorders for use in the field; color capability for use with computers that offer it; and a strong, compact tuner so that the set can be viewed in the one spot where it is very likely to be viewed: deep inside an office building. Although Morokawa points out that these applications do not preclude home use, he believes that pocket TV appeals most to consumers who want to watch on the go. Other manufacturers seem to share his perspective and either offer features that lend themselves to rugged mobility or plan to offer them.

The most common approach to the basic technology of display, used by all the major producers of LCD TV, is the full multiplexing of a large number of twisted-nematic picture elements, or pixels. This method is distinct from the direct addressing of a small number of pixels, which is used in the manufacture of LCD meters, watches, and industrial equipment [*ElectronicsWeek,* Sept. 17, 1984, p. 75]. Whereas direct addressing requires that each pixel be connected directly to the drive circuit, full multiplexing bypasses that requirement by placing a nonlinear element such as a thin-film transistor at each pixel.

It thus becomes possible to cram many thousands of LCD elements into a small space because the drive-circuit connections, which are larger than TFTs, have been eliminated. The TFT functions as a capacitor that provides a near-100% duty cycle for each pixel in the matrix; the matrix can then align itself according to the voltage corresponding to an external signal. Although the pixels cannot be addressed simultaneously, as they can in a directly addressable, memory-mapped design, this is not a disadvantage in a TV set. Broadcast signals are processed in sequential, row-by-row addressing.

The advantages that the full multiplexing of a pixel matrix offers over CRTs includes low power consumption and exceptionally thin construction. (Citizen's current 2.7-in. LCD TV measures less than ½ in. deep.) Considerable space is also saved, explains Morokawa, by mounting the thin-film-transistor circuits that drive the LCD directly on the display panel's substrates—which are designed for multipad direct connection.

A disadvantage is that a typical LCD TV matrix has substantially fewer pixels than a standard color TV—50,000 versus 500,000—which results in poorer intrinsic definition. Still, LCD manufacturers have not really had to confront this problem because the pocket TV's small screen size provides a relatively high resolution per unit area. In addition, LCD is a solid-state technology, meaning it is potentially more rugged than its CRT competitors.

Citizen's LCD driver, for example, uses a conventional low-voltage, high-density, silicon-gate CMOS design, while the signal-processing IC uses aluminum-gate CMOS technology. A specially designed circuit (details have not been made public) makes it possible to translate the low voltage applied to the matrix-arrayed LCD pixels into a bright display with good gray-scale resolution—effectively bypassing the more expensive high-voltage CMOS integrated circuits that a TV would otherwise require to process the broadcast signal and drive the display. The question of whether higher voltages might indeed be required for the 12-in. LCDs that Morokawa envisions remains to be answered.

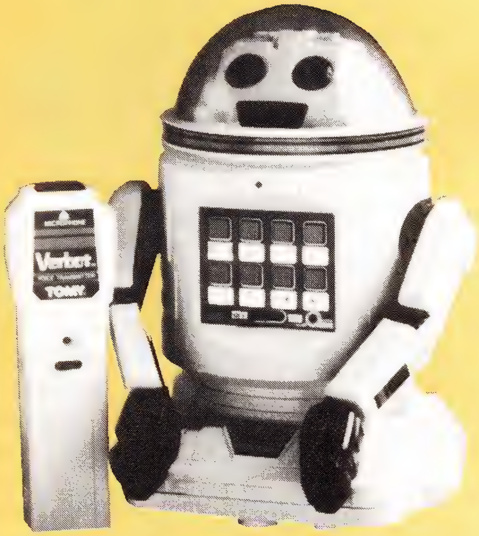
Meanwhile, the watch-cum-TV manufacturers are sticking with the low-voltage LCD technology they know best. At the WCES, Hattori-Seiko introduced a new thin-film-transistor television called the Color Pocket TV that currently has a retail price of about $500. It uses 52,800 TFT-driven pixels on a 2-in.-diagonal flat screen that can

Consumers take to novel technologies

Seiko's LCD color TV uses thin-film transistors for a picture that fits in a pocket. But at $500, its price is more than pocket change.

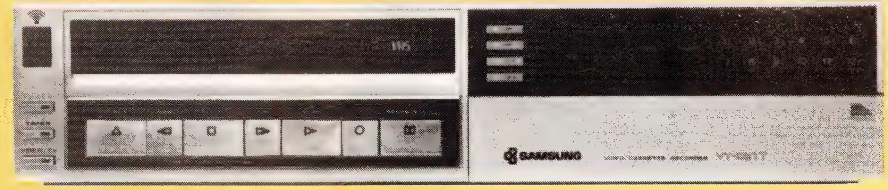
World's smallest black and white TV from Casio weighs 7 oz, runs on two AA batteries, and has a 2-in.-diagonal screen.

Video camera uses audio-size tape. Sony's 8-mm home-video product fits well in the hand.



Still marketed as toys, personal robots intrigue consumers and may one day be useful in the home.

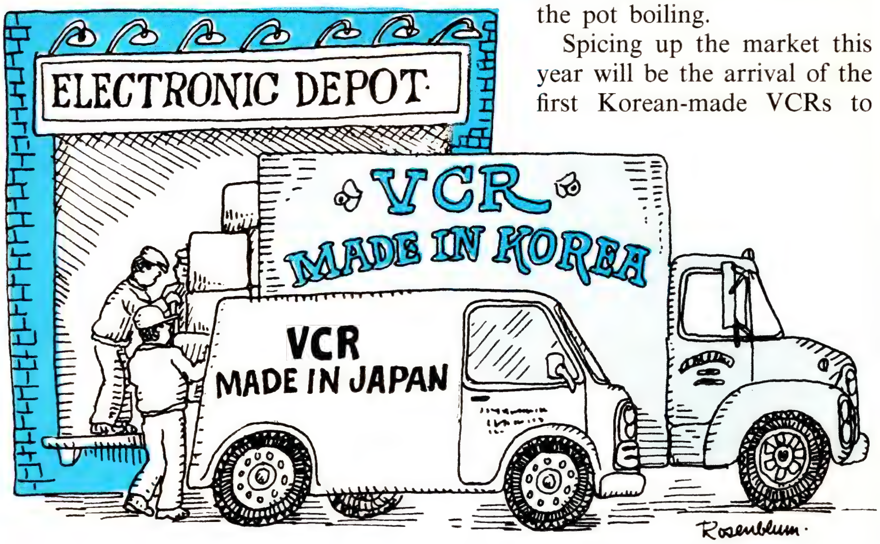
Koreans arrive with low-end VCRs. Samsung's front-loading model has all the basic features and is priced to move.



be seen in any light, according to a company spokeswoman. The key to the unit's brightness is in the TFT's high duty cycle—permitting a full saturation voltage to be maintained at each pixel—which enhances both viewing angle and contrast ratio.

The five AA batteries needed as a power source take up most of the Color Pocket TV's size and weight (6½ by 3½ by 1¼ in. and about 1 lb). "But future versions will need less power as TFT technology is improved," says William Akata, consumer electronics sales and marketing manager at Hattori-Seiko.

Such other manufacturers of flat-panel LCDs as Epson America Inc. and Casio Inc. are also using TFTs and twisted-nematic liquid crystals as the basis of their display technology. But they have approached the problem of miniaturization in other ways. Casio, for example, claims that its TV-21 is the "world's smallest [black and white] television." Like the Seiko Color Pocket, it also has a 2-in.-diagonal screen, but the Casio unit requires only two AA batteries to run. Of course, the black and white set uses less power.



Casio also uses solar cells in a projection screen above the LCD display. According to Andy Simon, manager of the firm's Television Division, the solar projection screen reduces power requirements while it concentrates external light to illuminate the LCD matrix. A mirrored surface on the inside of the projection screen also intensifies the available light while an optional electroluminescent backlight illuminates the display when external light is unavailable. Eliminating the speaker saves more space. An earphone whose cord serves as the TV's antenna handles the sound.

Epson's ET-10 color set has the same basic specifications as its Seiko competitor but uses a built-in fluorescent backlight system to enhance the 2-in. display in low exernal light. At the WCES, Epson also showed a modification (not yet available) to the ET-10 that uses a snap-on lens to increase the apparent size of the LCD screen.

Although Epson, Casio, Seiko, and Citizen agree that consumers will welcome further development of LCD technology when it is translated into products, Epson at least is exploring an alternative. According to Epson's marketing services manager, Scot Edwards, the firm is "talking about introducing a flat-panel CRT television." But that product's introduction could depend on how well Sony fares with its CRT-based Watchman.

Sony's Kawakami points to strong sales for the 2-in. Watchman and the probability of even stronger sales for the new black and white 4-in. Watchman version (no color Watchman is yet available) introduced at the WCES with a suggested retail price of $200. "We've exceeded our sales expectations for the flat-screen CRT, and it may turn out to be the way to go for pocket television. But the only thing that can make pocket TVs really popular is low price, and that won't happen until we have reason to produce them in quantity." According to Kawakami, Sony is "experimenting with LCD, although the price-to-performance characteristics of flat CRTs look more promising simply because a CRT gives a sharper, brighter picture."

Seiko's Astor maintains, however, that "virtually all TVs under 4 in. in the future will use liquid-crystal displays because LCD is inherently more rugged—a vital issue for portability." He predicts that within a year or two, the "jewel-like quality" of the liquid-crystal pictures that he says he has seen in the lab will be available to consumers. "Once the crystals are as bright and dense as a CRT, we'll have the market to ourselves—especially at $350 for a color set that you put in your pocket."

Koreans are coming

Elsewhere on the video frontier, VCR sales racked up a 78% increase in 1984. At 7.3 million units, the U.S. market for video equipment continues to be one of the hottest categories in consumer electronics. And judging from the action at the recent WCES, many new ingredients added in 1985 will keep the pot boiling.

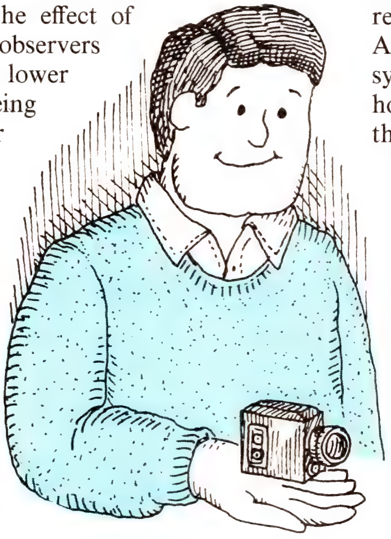
Spicing up the market this year will be the arrival of the first Korean-made VCRs to hit these shores—a development that has many in the industry worried about a new outbreak of price cutting. Japan's traditional manufacturers will fight back by peppering the market with a spate of new high-end product entries, including an improved Super Beta format and full-cassette Video Home System camera-recorders (camcorders) in the ½-in. tape VCR formats.

At the low end, another new product category will emerge with several vendors' introduction of video cassette players. To sell for about $200, these units cannot record; they are aimed at VCR rental businesses and consumers who are looking for a low-priced video-tape playback-only system as a second home unit.

The first digital TV sets will also make their appearance, together with a flood of stereo-ready TV products and 8-mm-format camcorder entries from an increasing number of vendors. Also promised in 1985 are the first TV sets to incorporate teletext decoders, as well as a 35-in. diagonal CRT from Mitsubishi—the largest yet offered for the consumer market—that could provide competition for projection-TV systems [*ElectronicsWeek,* Jan. 14, 1985, p. 10].

VCR products made in Korea are expected to enter the U.S. market in March, when export restrictions on Japanese licensing agreements to Korean manufacturers expire, one of the most-discussed video issues at WCES. Samsung Electronics America Inc. and Goldstar Electronics International Inc., on the main WCES exhibit floor, both featured VCR lines built by their Korean parent companies.

Although the suggested retail prices for the Korean machines weren't as low as some industry observers had expected—both firms' low-end models carried a suggested price of $399—many observers expressed concerns over rapid price chopping once the machines actually arrive. "The Koreans' getting into the business is going to create some serious market-stability problems," predicts Dave Ginsberg of Hi Fi Buys, an Atlanta video retailer. "If the quality is good, they're [Korean manufacturers] going to be tough. If not, that will be a selling point against them," adds Mike Adray of Adray's, a retailer in Dearborn, Mich.



For their part, officials of the Korean firms point out that VCR prices are already falling and deny plans for aggressive price cutting, adding that the effect of their entry has been overplayed. Other observers agree. "I'm not certain how much lower prices can drop. We're already seeing street prices for Beta machines at under $300," observes Raymond L. Boggs, a consultant with Venture Development Corp., a market research firm.

Many in the industry are counting on VCR systems with enhanced features and capabilities to help hold the line for established manufacturers' units. Included are the increasingly popular ½-in.-tape-based VCRs with stereo high-fidelity audio capabilities. Sony recently announced plans to begin supplying systems based on the emerging 8-mm format under its own brand name in Japan and later in the U.S. But the firm also pledges to provide advanced new products to maintain sales in its ½-in. Beta line.

Due for mid-year introduction in the U.S. from Sony, for example, are the new Super Beta units. The firm says the units offer a 20% gain in picture resolution compared with conventional Beta VCR models and are compatible with the older machines. The improvement was achieved by shifting the video carrier-signal frequency by 800 kHz (from 3.6 to 4.8 kHz up to 4.4 to 5.6 MHz), which results in a wider luminance bandwidth for sharper picture detail.

VHS skeptics

Although some backers of the competing ½-in. VHS format conceded the picture improvement in the new Beta format, they were skeptical of the compatibility of the Super Beta system with conventional Beta models. R. Jay Sato, Betamax marketing merchandising manager for Sony Consumer Products Co., concedes that any carrier-frequency shift larger than 800 kHz would have jeopardized compatibility. But he maintains that the change will not be enough to prevent playback of conventional Beta tapes on the new-format machines, or vice versa. Prices for the Super Beta systems, though not yet set, are expected first for the high-end systems, followed by those for medium-priced systems, Sato says.

On the camcorder front, VHS suppliers including Panasonic Co. and General Electric Co. are counting on drumming up interest in the format with new units that can record and play back for two hours or more using a full-size VHS cassette [*ElectronicsWeek,* Jan. 7, 1985, p. 9]. Previous VHS camcorders supplied here by the JVC Corp. of America have been limited to a record-and-play time of 20 min using a special VHS-C cassette while competing Betamovie units offer full-cassette record times but no playback capabilities. Sony and other Beta-format makers will fight back, however, with new Betamovie units that feature a solid-state charge-coupled-device pickup, offering improved performance, lower power consumption, and reduced size and weight compared with current Betamovie systems that are based on tubes.

Also in the contest to win the pocketbooks of consumers who are looking for one-piece shoot-and-record capabilities is the new 8-mm format. Although manufacturers of conventional systems based on ½-in. tape have been holding back until now for fear of stunting the ½-in.-tape-VCR boom, a growing number will begin supplying the potentially more compact 8-mm units this year. Firms such as Sony, GE, and Canon will join those already in or soon to be in the 8-mm business, including Kodak, Polaroid, and Sanyo.

Digital TV sets based on the West German Digit 2000 chip set developed by ITT Intermetall GmbH will also begin hitting the U.S. shores this year. But high-end pricing is expected to blunt its market impact in 1985. Toshiba Corp., for one, is expected next month to begin shipping a digital model shown in prototype at last year's Summer Consumer Electronics Show in Chicago. Panasonic, Mitsubishi, and Zenith, which showed digital sets at the WCES, have also promised deliveries this year.

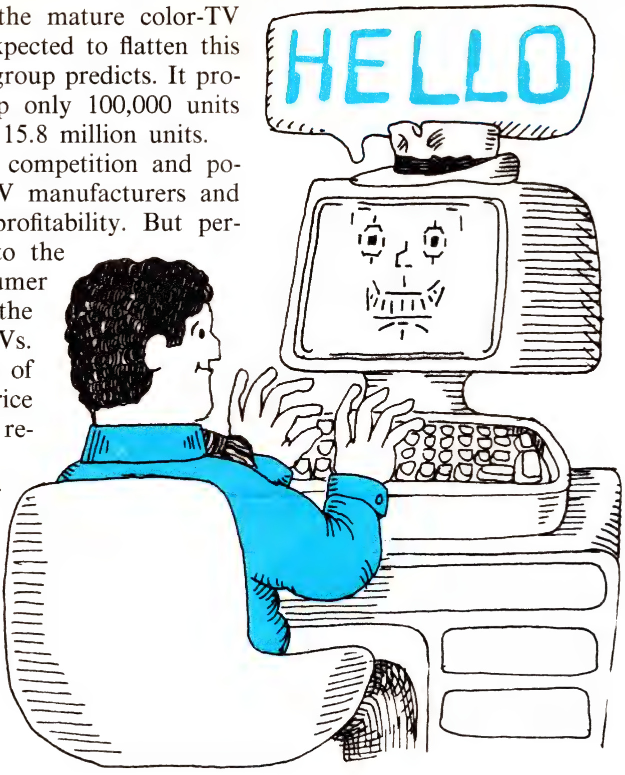
Strong performance

Overall, despite some turmoil and concerns over low profit margins, video manufacturers expect strong sales this year for mainline products. VCRs are now in an estimated 17% of U.S. households, and the Electronic Industries Association's Consumer Electronics Group projects 1985 VCR sales of 9.5 million units, up 30% from last year's record-setting pace. Many industry sources even consider that projection conservative. "I can easily see VCR penetration rivaling that of color TV by the end of the decade," declares Jack Pluckhan, president and chief executive officer at Quasar Co.

Shipments of blank and prerecorded video cassettes are expected to rise by 32% and 50%—to $122 million and $33 million—respectively. Fierce price competition, particularly in the blank-tape arena, however, will probably continue to affect profitability.

Following big growth years in 1983 and 1984—23%

and 13%, respectively—the mature color-TV and receiver market is expected to flatten this year, the EIA consumer group predicts. It projects dealer shipments up only 100,000 units over last year's figure of 15.8 million units.



As with VCRs, heavy competition and potential oversupply has TV manufacturers and retailers worried about profitability. But perhaps most encouraging to the industry is the consumer group's projection for the selling prices of color TVs. After four straight years of declines, the average price per unit is expected to remain stable at $340.

Although voice synthesis as yet has less potential than video equipment for substantial sales in the home, the technology nonetheless proceeds to grow apace. Votrax Inc. a Troy, Mich., manufacturer, is trying to expand this market by promoting a product it calls the Personal Speech System.

"This is one of the few completely self-contained voice synthesizers that can translate computer data into unlimited spoken English," says Robert Chencinski, national sales manager. "In addition, we've designed it to be compatible with virtually any home computer from the [Commodore] VIC-20 to the IBM PC, as long as it can accept a standard serial or parallel interface connection."

The user enters the words to be spoken with the computer keyboard—giving the speech system an almost unlimited vocabulary. An SC-01 CMOS chip developed by Votrax phonetically synthesizes continuous speech at a rate of 70 b/s by combining 64 different phonemes in the appropriate sequences. Instructions from an off-the-shelf Z-80 microprocessor are interpreted by applying the rules of standard English pronunciation. "The resulting speech is 95% conversationally accurate. The inaccuracies that do crop up are due to unavoidable inconsistencies in written language," according to Chencinski.

Speech with memory

Unlike speech-synthesizer boards that are plugged into a computer's input/output port, the speech system has its own memory—allowing the host computer to perform other tasks while speech and sound are processed. To help produce a more natural-sounding speech—including special word and phrase emphasis and various inflections—the unit has 256 programmable frequencies and 16 programmable amplitude levels. In addition, nonspeech sound effects and musical tones can be mixed with speech independently of the host computer.

Chencinski sees the major applications for the Personal Speech System in small businesses and small-scale public services. These include spoken data transmission to handle sales orders and financial transfers; narration of graphic displays; computerized product demonstrations; and spoken verification of data input that can be used by educational institutions and law enforcement agencies.

"Voice synthesis is just beginning to come into the home," maintains Chencinski. "Its main users will be the handicapped and computer enthusiasts who view a voice synthesizer as an intriguing peripheral."

Market analysts are hesitant about offering precise predictions about where voice-synthesis equipment might figure in the home. Ann Conway of Venture Development Corp. emphasizes that not all talking products being offered are equally appealing to consumers.

"The vast majority of consumers—if they want speech synthesis at all—are interested in automobiles, personal computers, and calculators with speech-synthesis capability," she says. "Fewer than 3 out of 10 are interested in office products, medical products, or home-security equipment with speech synthesis." In aggregate sales, the firm expects about 14 million units to be shipped in 1985, with an expansion to 37 million units by 1987. Total sales for all categories of voice synthesizers should exceed $72 million in 1985. No figures are available for home products as such.

Educating consumers

According to Conway, the critical issue facing manufacturers is that of user acceptance. "For some product categories like clocks and home security, people say that speech synthesis isn't useful. Bells and buzzers accomplish the same function," she points out. "Clearly, speech-synthesis manufacturers need to educate consumers about the potential applications of this feature."

The other aspect of mechanical speech—speech recognition—is nearly assured of market acceptance; its only restraint is the lack of products that can understand more than a few words from a human voice. Most industry observers are convinced that more capable speech-recognition equipment is on the way [*ElectronicsWeek*, Oct. 22, 1984, p. 83], but for now the state of the art in the consumer market—the under-$200 price range—is represented by products such as Micromint Inc.'s Lis'ner 1000, a plug-in board for Apple II and Commodore 64 home computers (it can also be used with other 6502-based systems).

This latest product from the firm is speaker dependent, and functions as a parallel voice-entry peripheral to the keyboard. When Lis'ner hears a word it recognizes, it sends a preprogrammed sequence of characters to the keyboard input handler as if it had been typed (64 words can be entered at one time from an unlimited vocabulary by microphone, and they are stored on templates). Disk operating system and keyboard commands as well as numbers can be spoken into the host computer while the user busies his hands with other work. Although no one is predicting huge sales for this and similar products, its low price and ease of use is expected to hasten the eventual use of voice recognition in the home.

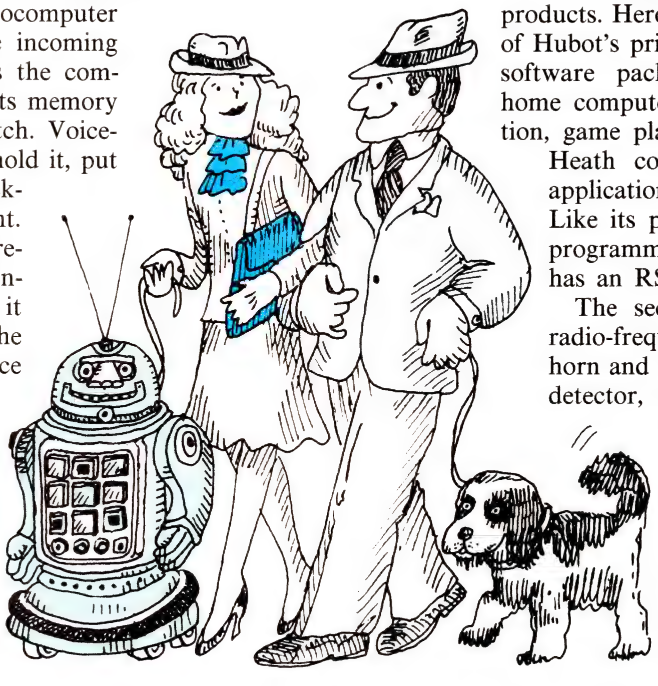
Personal robots come home

Although personal robots are still far from practical—in the sense of being able to do useful chores around the house—the robots can indeed be profitable for their manufacturers. Consumer interest in personal robots was strongly in evidence at the WCES, and a record number of companies exhibited their wares.

Tomy Corp. makes toy robots [*ElectronicsWeek,* Oct. 15, 1984, p. 55]. One of the robots, called Kikuzo in Japanese and Verbot in English (the German version presumably will have a different name), features voice recognition of eight separate commands transmitted over a radio link. Because its voice recognition is speaker dependent, the user must train the robot to respond to his or her vocal characteristics.

The robot's electronics consist of a one-transistor superregenerative receiver (of the type used for the remote radio control of mechanical devices), a simple comparator, a Matsushita 1541 high-speed 4-bit n-MOS microcomputer with 1-K-byte of read-only memory, 4-K bits of random-access memory, and driver transistors. Voice recognition uses the cheapest, simplest method possible: the microcomputer counts zero crossings in the incoming speech waveform and selects the command from among those in its memory that provides the closest match. Voice-controlled actions are: stop, hold it, put down, go straight, go backward, turn left, and turn right. The robot will correctly respond to most sentences containing those words because it has no understanding of the other words in the sentence and can't be confused by them. The price of the 9-in., 1-kg unit is about $50.

Another company building what it calls a personal robot is Hubotics Inc. Michael N. Forino, Hubotics's president, believes that "being a mobile personal computer is not enough, and fun and games are not enough. A personal robot has to be a multipurpose appliance that provides convienience and reliability to the consumer." Thus, unlike other personal robot manufacturers, Hubotics touts its product, called Hubot, as being really useful, rather than as simply an intriguing toy or worthwhile educational tool.



For $3,500, Hubotics offers a 44-in.-high mobile media center that includes a black and white TV, stereo, and Atari game system. It also has a built-in personal computer made from off-the-shelf parts that uses a CP/M 2.2 operating system with a Z-80 microprocessor. Instructions are entered by way of a detachable ASCII keyboard and stored on 5¼-in. floppy disks residing in a built-in drive. Forino stresses that any part of Hubot can be removed and replaced with an upgraded version, including the computer's plug-in boards. Unfortunately, it was never made clear what current versions of the robot might be instructed to do—beyond simply duplicating the functions of a personal computer.

Although no one at Hubotics predicted sales figures for the immediate future, the company seems confident that forthcoming additions for its robot—such as an articulating arm and a light-duty vacuum cleaner—will soon propel it to profitability.

The most successful personal robot manufacturer, Heath Co., is also convinced that robots that can function above a rudimentary level will one day take their place in the average home. "But such robots are still a way off," says David Altwies, vice president of marketing at Heath. "Nonetheless, Heath has been encouraged by the success of Hero I [the first truly programmable home robot that it introduced in kit form in 1983], and we think the market for home robots is definitely expanding to include people who aren't necessarily electronics enthusiasts."

Standing behind Altwies's words is the new Hero Jr., which comes fully assembled and "is marketed like a computer peripheral," according to Wayne Wilson, Heath's manager for general consumer products. Hero Jr. sells for about one third of Hubot's price and is designed to accept software packages that perform many home computer functions, such as education, game playing, home security (which Heath considers its most important application), and Basic programming. Like its predecessor, Hero Jr. can be programmed by any computer that has an RS-232-C interface.

The security system consists of a radio-frequency receiver with an alarm horn and annunciator, infrared motion detector, and a hand-held command transmitter to control the robot's movements. The system is activated when Hero Jr. detects an intruder who is unable to signal the proper password (either by speaking it or entering it on Jr.'s keyboard). Jr. then shrieks an alarm, dials the police with an rf-telephone interface, and tells the intruder to get out (or whatever his owner has programmed it to say for the occasion). The robot's movements can also be preprogrammed so that it functions as a type of peripatetic watchdog. Heath's marketing people are encouraging consumers to think of Hero Jr. as a pet, which is one step up the evolutionary ladder from a toy. ☐

Wesley R. Iversen in Chicago wrote the VCR section. Charles L. Cohen in Tokyo did additional reporting for the robot section.

LOCKING UP SYSTEM SECURITY

A keyed-access computer-security system, implemented in hardware, cannot be be broken by unauthorized users

☐ *by Joseph S. Kontur and Lawrence Letham*

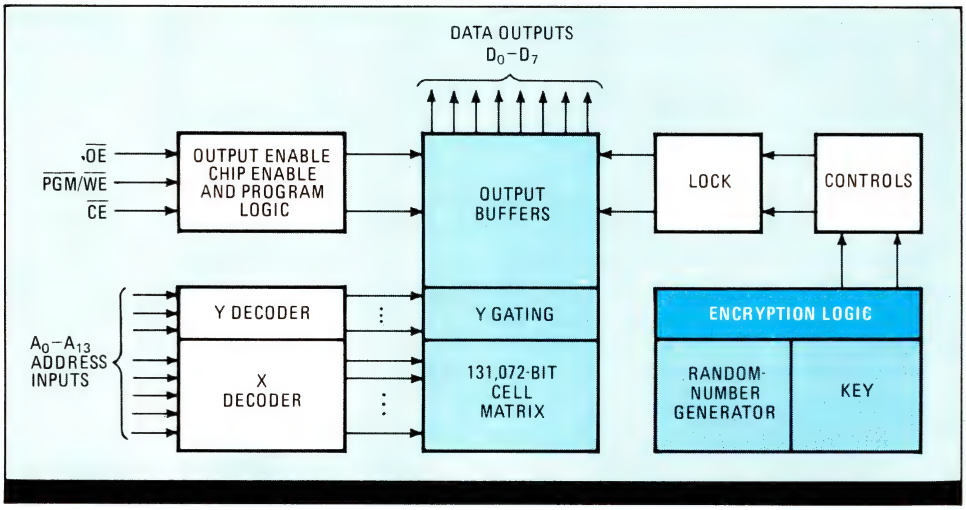
For many companies, when a computer system fails, work comes to a standstill because so much of what businesses do depends completely upon those systems. But a computer system may have an Achilles' heel of another sort. Unauthorized access to one can range in seriousness from a harmless prank to a theft of such magnitude that it makes notorious armored-car robberies seem trivial by comparison.

The clearest area of sensitivity to unauthorized tampering with data is electronic-funds transfer. But unauthorized access to other types of data can be equally harmful. For example, one company was forced to declare bankruptcy because its accounts-receivable data had been destroyed by a disgruntled employee. In another instance, a company's proprietary process-technology data was stolen through an unauthorized data transfer over telecommunications lines.

Access to computers that are primarily batch-oriented and located in a central data-processing department is relatively easy to control. The growth of time-shared hosts and remote user stations with dial-in access capability, however, has made it more difficult to adequately protect the system from unauthorized access.

There are several ways to provide this security. Probably the simplest and least costly method is a system of software passwords. Many application programs already have provisions for password access built in.

Another method involves automatic call-back. In this system, remote users cannot dial in directly to the system itself, but instead gain access to a program to which they present appropriate identification codes. The host system then hangs up, calls back the user, and, at the same time, notes the date, time, and telephone number.



1. Extra blocks. The Intel 27916 is similar in architecture to a standard 16-K-byte EPROM, but it has additional function blocks. These provide the necessary keyed-access authentication features, such as the random-number generator and encryption logic.

Yet another method, which is best accomplished during system design, provides fast and practically pickproof system-access security. Furthermore, it provides a major advantage from the standpoint of its effect on authorized users, because it is transparent to them. This method uses keyed-access memory components that act as a lock and key between the remote system and the host.

Access-security methods examined

The software-password method is probably the least expensive method available that offers reasonable access security, and in addition, these passwords are also relatively easy to reprogram. There are problems with this method, however.

First, most software passwords are fixed for predetermined lengths of time. This increases a potential intruder's chances of guessing a password. Second, when passwords are transmitted over communications lines, they can be intercepted by anyone with the proper monitoring equipment. Finally, subscribers are responsible for remembering and safeguarding their software passwords, which places an additional burden on the user.

The automatic call-back method can provide a greater degree of system-access protection than software passwords. Unlike software passwords, users do not have to remember and safeguard passwords, which makes the process more user friendly. However, the system is more complicated than a software-password system because it involves the implementation of some kind of call-back algorithm. In addition, it is relatively slow, with average delay times ranging from 15 to 30 seconds.

In spite of the protection afforded by these two methods, newer ways of safeguarding computer systems from unauthorized access need to be developed. As Donn B. Parker, computer security analyst at SRI International, has written, "With the advent of the information age, the potential threats and losses to human beings and property have not necessarily increased or decreased. They have simply changed—security measures have to be changed as well."

One such new security method builds a hardware barrier between the intruder and the system. This method makes use of semiconductor technology and encryption algorithms to set up a virtually impenetrable security mechanism.

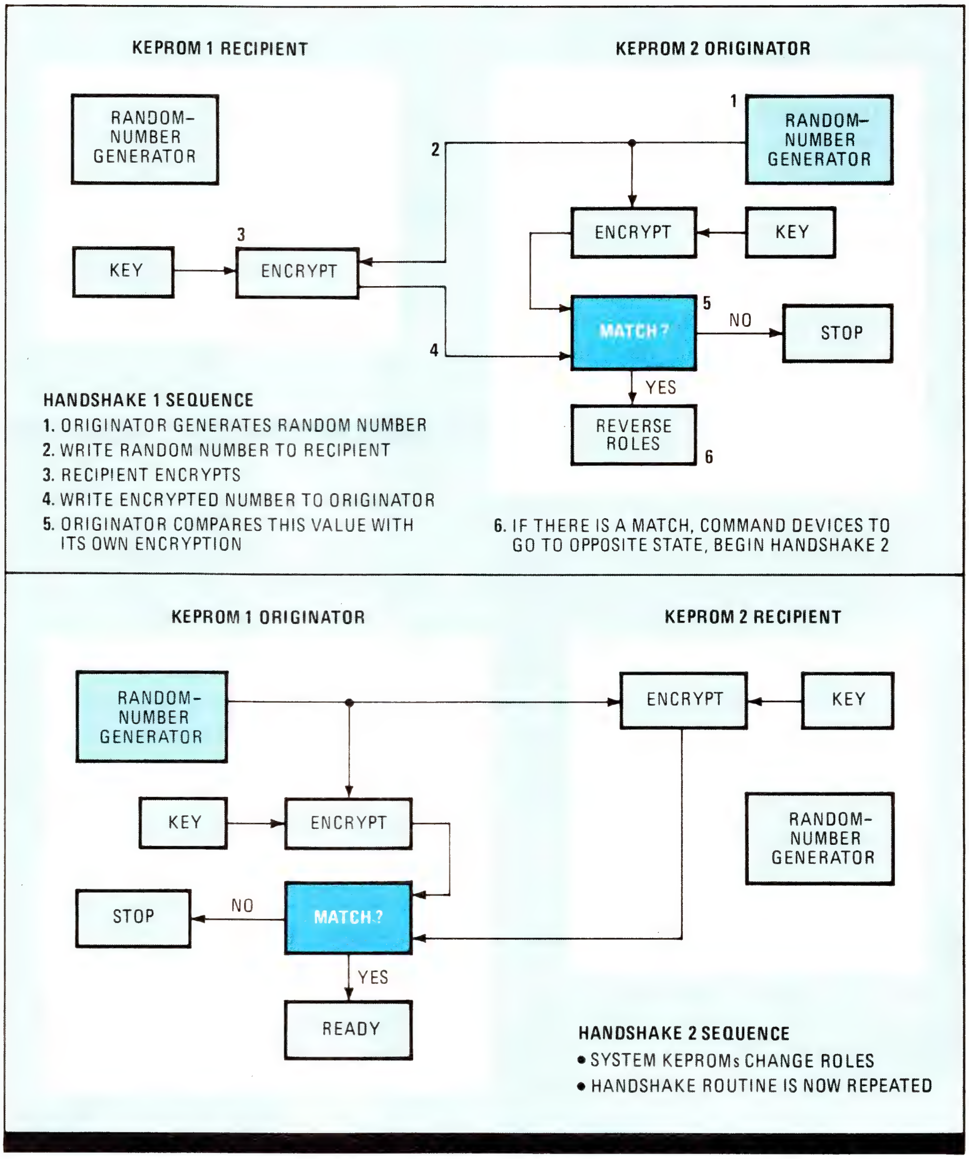
This new system-access security method involves the use of a pair of keyed-access memory devices, one installed in a remote station and one in the host. These two components act as lock and key, preventing access to the system from any remote station that does not contain one of these devices with a key that matches that of the host.

No passwords are needed. As soon as access is attempted, the two devices determine whether their lock and key match; if they do, the system is opened. At no time is the key data ever transmitted over a telecommunications line, thereby making it impossible to tap and monitor the line to determine the key. Not until the matching process has taken place is any data transferred over the lines. Thus, as with the other two methods, data transmission can occur only after access has been authorized.

The keyed-access memory system has many advantages over the alternative methods discussed above. Users do not need to remember passwords, which makes the system more user friendly, and key data cannot be compromised because it is not transmitted over a line. A keyed-access memory is easy to use—as easy to use as a standard programmable memory device. Security is in hardware, not in the hands of the user. Other methods of system-access security (encrypted data bus, for example) can be implemented to augment the level provided by the keyed-access memory device. Verification time is limited to about 0.1 s and is completely transparent to the user.

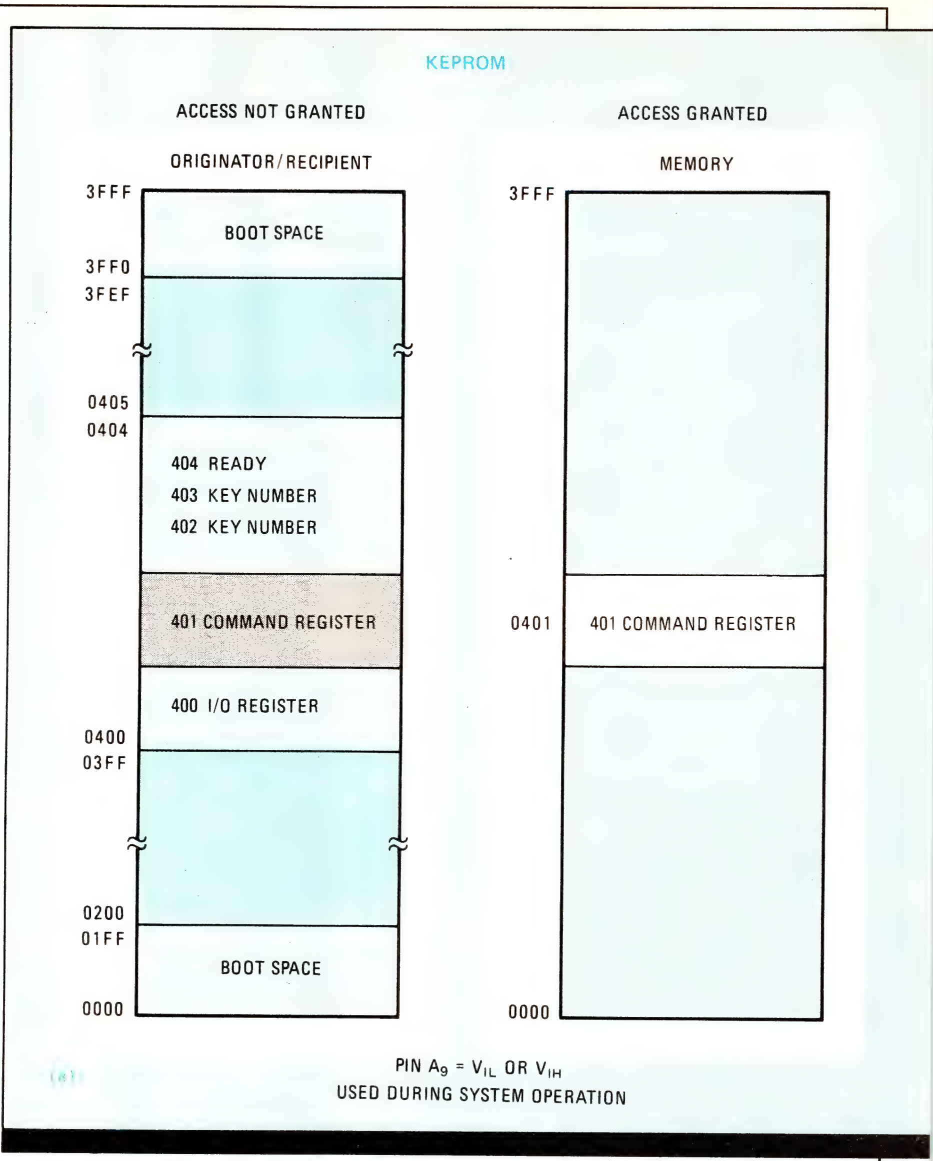
A keyed-access EPROM

Intel designers have developed the Keprom device, which is a keyed-access electrically programmable read-only memory (27916) based on the design of a 16-K-byte EPROM but containing additional function blocks to support the keyed-access requirements (Fig. 1). In effect, this hardware causes two Keprom devices—one in the



2. Shaking hands. The Keprom device engages in a bilateral handshake sequence before permitting the data transfer. The two handshake routines ensure that the system security provisions cannot be defeated by tampering with the equipment at only one end.

3. Double duty. The 27916 can operate as either a Keprom device (a) or a key manager (b). The locations of key data, readable storage, protected-readable storage, and control registers depend on the configuration. Programming is done by the manufacturer (c).



remote system, one in the host—to conduct a sequence of two authorization handshakes, in which each one identifies the other as valid. One handshake is initiated by the remote system's Keprom device and the second by that of the host (Fig. 2). This makes it virtually impossible for an intruder to break into the system by tampering only with the host or only with a remote system. Modifications on both ends would be necessary to achieve unauthorized access.

Without the second handshake, it would be possible to make the remote Keprom device send back a match verification even though one had not taken place. The second handshake, however, renders this impossible. An intruder who wishes to unlock the system would have to be able to obtain access to both of the Keprom devices and replace them, or the transmission of data could not take place.

Only two blocks of data are passed over the lines before access is achieved: the first is a random number and the second is an encrypted result, both provided by the Keprom device. The encrypted result is the product of a substitution-permutation algorithm that is performed both on a 64-bit key and on the 32-bit random number.

The first thing that happens in the verification sequence is that the remote station's Keprom device generates its 32-bit random number and passes it over the lines to that of the host. Then, both stations process the encryption algorithm using their own 64-bit keys. The host system's Keprom device then sends its encrypted result back over the lines to the remote system's Keprom, which then compares the received result to its own encrypted result. If they match, the process is repeated with the two Keprom devices exchanging roles.

Bootstrap area

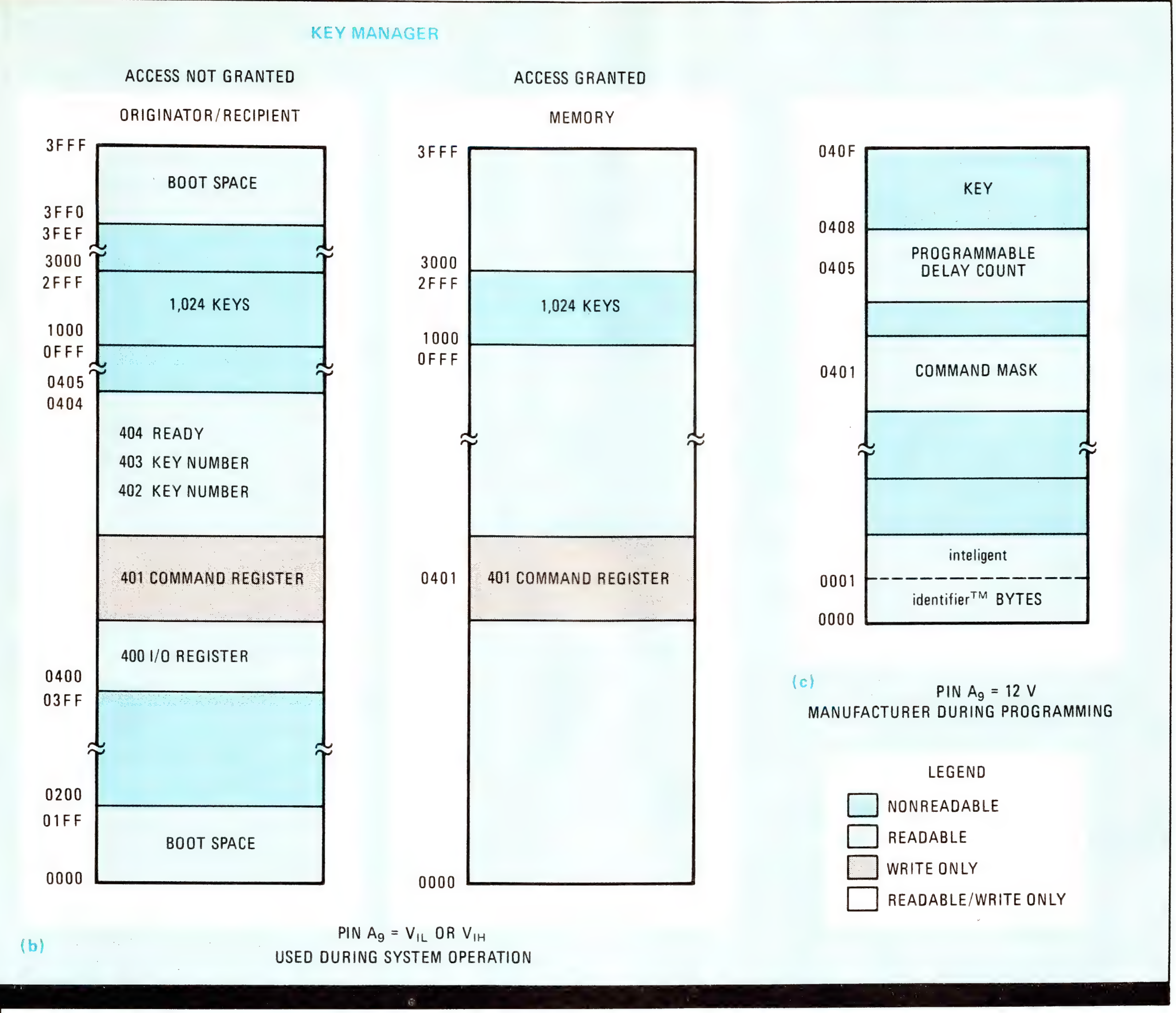
The 27916 is organized in such a way that a portion of the memory is in what is called a boot space, or bootstrap area, which is always readable. The 64-bit key section is never readable, and the rest of the memory locations are readable only when access has been granted (Fig. 3). The boot space is used to store the instructions that a microprocessor will execute when the system is turned on, allowing the system to step through the authentication process.

Because the keyed-access EPROM is implemented in EPROM technology, it can be used in several different configurations. A 27916 Keprom device can be programmed as a keyed-access EPROM, as just described. It may also be used as a key manager in a host, permitting secure access by up to 1,024 different remote systems, each with its own unique key. In addition, it can be used as a standard 128-K EPROM component.

In comparing the memory maps of the first two cases (Fig. 3a,b), it is apparent that some of the firmware space has been traded off for the benefit of having the single part configured as a key manager in order to provide 1,024 unique system-access locks.

When configured as a standard EPROM, the 27916 resembles a 27128 in all respects. In this configuration, it is fully erasable and reprogrammable. As a keyed-access EPROM, it allows data at locations 0200 (hex) through 3FFF (hex) to be read only after a successful authentication handshake sequence has taken place. This configuration is selected by programming a special EPROM bit. To ensure security, these memories must be used in matched pairs, with matching keys.

As a key manager, the 27916 can be used in authentication handshake sequences with up to 1,024 uniquely



keyed 27916s, but only 8-K bytes are available for firmware storage (0000 through 0FFF and 3000 through 3FFF). The remaining memory locations contain the keys and are not readable or reprogrammable (Fig. 3c).

The first step in implementing a secure Keprom device system is to program in the code required to perform the handshake, and the firmware to be secured. Programming is performed in the same manner as for a standard EPROM. The typical programming time for a 27916 is about two minutes.

Program in the key

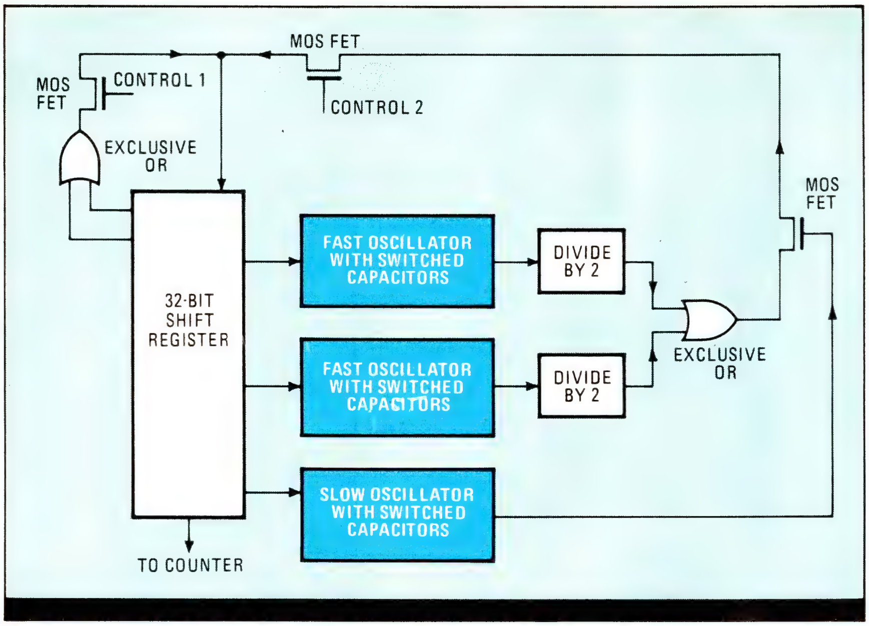
Once the 27916 has been programmed, the 64-bit key and the data that are required to configure it as a Keprom device or key manager are also programmed in. Finally, a lock bit is programmed in to render the memory array unreadable unless a handshake with a second Keprom device takes place. When used in key-manager systems, a key number must be programmed in along with the keys. The key number provides the key manager with the address of the single key (out of a possible 1,024) that it should use to perform the handshake.

It is a relatively easy matter to integrate Intel's 27916 within a design; it is just another memory in the space that is reserved for nonvolatile memory (program memory) storage. Any existing system that is already designed to use a 27128 or equivalent can be retrofitted for 27916 system-access security by replacing the 27128 with the 27916, removing the jumper on the socket that joins pins 27 and 28, and then connecting the Write Enable line to pin 27.

For new designs, these requirements can be provided at the outset. The Keprom device will provide all the memory storage of the 27128 that it replaced. However, only about 500 bytes of boot-up space will be initially readable.

The Keprom device has an access time of 250 ns, a speed that is consistent with standard EPROMs such as Intel's 16-K-by-8-bit 27128. As with Intel's other erasable programmable memories, the 27916 is implemented using high-speed n-MOS silicon-gate technology (HMOS-E). It will work with any high-performance microprocessor without requiring wait states, and it also uses the industry-standard pinout approved by the Joint Electron Device Engineering Council.

Several techniques are used to ensure the keyed-access


MOS FET
MOS FET
CONTROL 1
CONTROL 2
EXCLUSIVE OR
32-BIT SHIFT REGISTER
FAST OSCILLATOR WITH SWITCHED CAPACITORS
FAST OSCILLATOR WITH SWITCHED CAPACITORS
SLOW OSCILLATOR WITH SWITCHED CAPACITORS
DIVIDE BY 2
DIVIDE BY 2
EXCLUSIVE OR
MOS FET
TO COUNTER

4. Pick a number. The random-number generator utilizes three oscillators with switched capacitors. The outputs of the two fast oscillators, after going through divide-by-two circuits, are fed back to a shift register, which then changes the oscillator frequencies.

EPROM's system-access security. Incorporating the 64-bit key means that there are approximately 18×10^{18} possible unique key combinations. Even with a computer-aided lockpick that tried different combinations at a rate of one every 0.08 s (the fastest rate at which the Keprom device will allow repeated handshakes), it would take 46 billion years to try every combination. An exhaustive search, therefore, is not possible.

The keyed-access EPROM permits users to specify one of four delay codes that govern how frequently an authentication handshake can be initiated. These may be selected as frequently as one every 0.08 s up to one every 15 s. Slowing the repeated handshake intervals to as few as one every 15 s increases user delay but more than eliminates any reasonable possibility of using cryptanalytic techniques to pick the lock. By virtually eliminating the practicality of guessing the key combination, it is important to ensure that the random numbers are truly random so as to eliminate that possibility as a means to unauthorized access.

Random-number generator

A well-designed random-number generator is critical to maintaining the security of the system. If one or more numbers were to appear more frequently than others, it would be possible to reply with the correct encrypted result by waiting until those frequently occurring random numbers appeared again. A patent is pending for the on-chip random-number generator in the 27916 (Fig. 4). In 900,000 samples, it was found that 99.97% of the numbers appeared only once. The most frequently occurring number appeared only 18 times. In addition, 50.15% of the bits were 1 bits. An ideal case would be 50%, but an actual value of 50.15% indicates practically ideal randomness.

One immediate benefit of a hardware access-security implementation is speed; the other is user transparency. In integrating a system whose remote terminals transfer data to a central host, a Keprom device configured as a key manager is designed into the host, and Keprom devices configured as individual keyed-access EPROMs are installed in the terminals. An authorized terminal will achieve host-to-system access within 0.1 s. The passage of random numbers, encrypted results, and verification signals goes undetected by the user.

Attempts to circumvent this scheme require tampering at both the terminal and the host system because of the back-and-forth authentication handshake sequence enforced by the Keprom device. Keys can never be read after the device has been programmed. A 64-bit key makes it impractical to attempt random combinations. This is discouraged even further by a programmable means of increasing the intervals between consecutive attempts.

With the authentication dependent not only on the unreadable 64-bit key but on a complex algorithm in which the key and nearly ideal random-number operands produce an encrypted result, the difficulty in cracking the system increases by several orders of magnitude. It would be impossible to implement this same level of difficulty in a software scheme without creating much longer access delays.

Furthermore, it would not be possible to provide, through software, the same degree of security to the key as can be achieved in a programmable hardware device, because the hardware implementation does not allow key information to be read under any circumstances. The Keprom device cannot be deciphered even by attempting to reverse-engineer the part, because it is not mask-programmed.

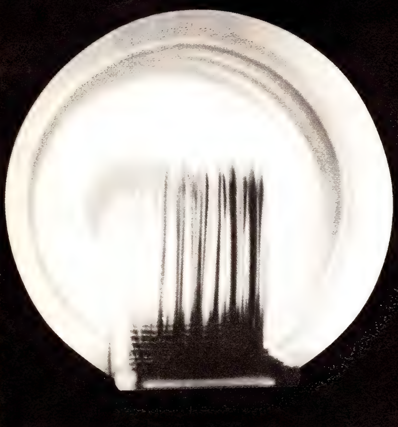
By providing these security features in a memory with an industry-standard pin configuration, it becomes a relatively simple process to make provisions in new or existing system designs for replacement of a standard EPROM with the keyed-access EPROM. This involves a minor hardware change and the addition of a few bytes of code to the system-initiation sequence.

Supporting a large system with up to 1,024 remote stations that must have access to a host is no more difficult than supporting only one remote system. It requires no additional hardware and very little additional system software, because the management of the several keys is done by a single key manager in the host. When compared to software-password or auto-call-back access schemes, the use of keyed-access memories is a significantly faster, simpler, and more secure approach to system-access protection. ☐

HMOS is a patented process of Intel Corp.
Keprom is a trademark of Intel Corp.

Joseph S. Kontur is a product marketing engineer and Lawrence Letham is a design engineer, both in the programmable memory operation, Intel Corp., Folsom, Calif.

PECOR



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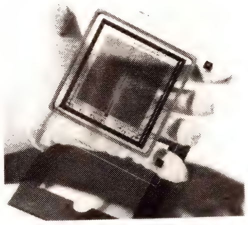

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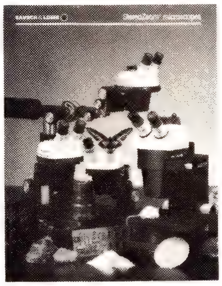

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How to keep from the electronic war.

being a casualty in

Is the electronics industry going the way of other industries?

There used to be 600 automobile manufacturers in the United States. Today there are four.

Once there was a brewery in every city. Today most of them are gone.

Today there are 200 personal computer manufacturers. How many will there be tomorrow?

The shakeout has started. Yesterday's darlings are today's disasters. Many companies have seen their reputations shattered. And the casualties continue to mount as competition intensifies.

Technology on a rampage.

Today's rampaging technology has done in many of yesterday's heros.

Such was the case when the 16 bit technology wiped out the computer companies still working with 8 bit technology. Or when the marketplace gave the VCR the nod over the videodisc.

Some say PBX technology will replace local area networks. And CMOS will overrun NMOS. And laser optical networks will challenge satellites.

Where do I get my Edsel serviced?

Customers are concerned. Nobody wants an orphan. Who wants to be stuck with a product without service, without spare parts, without product enhancements?

What customers do want in today's fast-changing marketplace are "credentials". They want assurance that the company they're buying from will be around after the smoke clears.

Survival requires better decisions on such things as technology, positioning, marketing and distribution. Decisions that have to take into consideration not only other U.S. companies, but global competitors as well.

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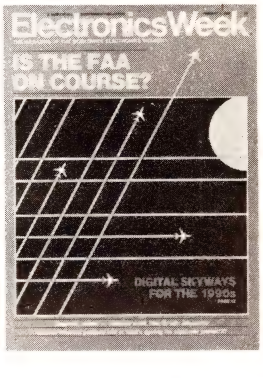

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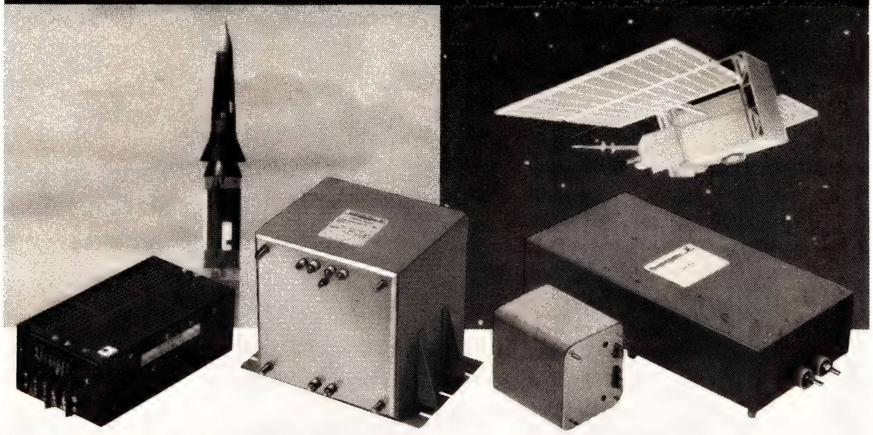

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Communications Systems Equipment Design is devoted entirely to international coverage of the communications segment of the electronics industry. It is produced by a team of experienced technical editors dedicated to providing readers with the most complete and accurate technical information available. A typical issue includes detailed technical articles focusing on significant trends or techniques authored by industry experts, provides in-depth technical articles and introduces new products.

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NEW PRODUCTS

PC DIGITIZES IMAGES QUICKLY

A stand-alone personal image processor digitizes a 384-by-480-pixel frame from any RS-170 source in a fraction of a second

☐ *by Tobias Naegele*

Boasting a diverse range of applications, from police work to weather analysis, the R-85 personal digital image processor from Rabbit Associates Ltd. is a complete stand-alone system.

The Taiwan company, which specializes in the development and manufacture of digital-image-processing equipment, says the R-85 could be used by remote medical, military, or weather stations to obtain help in the diagnosis and analysis of information from other more centrally located stations. Law enforcers, the company suggests, could use the device to transmit high-quality photographs or drawings of suspects.

The R-85's video digitization module accepts RS-170 video signals from vidicon-tube cameras, charge-coupled-device cameras, and consumer and commercial videotape players. The unit can digitize an RS-170 frame in just 1/30 s, directly mapping the image into the CPU's main memory with a resolution of 384 by 480 pixels by 8 bits. What's more, the image can be stored on the computer's floppy-disk drive or on an optional hard-disk drive.

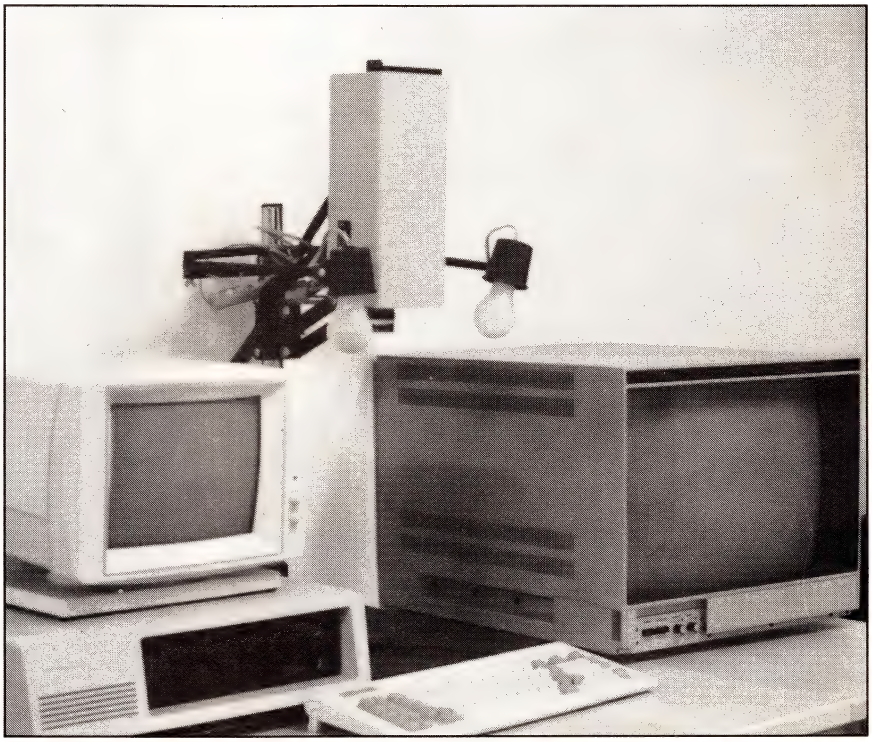
An image-communication module that will convert a digital image into a sequence of voice-grade signals, and vice versa, for transmission over standard telephone lines is also included. The voice-signal format is compatible with several organization standards including the World Meteorological Organization standards for weather facsimile transmission and the United Press International news network standard, and it can transmit a full 480-line gray-scale image in 65 s.

The 190-K-byte RAM refresh memory has three 256-byte lookup tables, each of which can generate an RS-170-compatible composite output signal. In addition, the lookup tables also can simulate color on displayed images.

The system's image-processing software helps perform several functions, including the use of user-defined software cursors that are controllable by either a joystick or a keyboard, picture statistics, and a variety of two-dimensional manipulation such as picture warping, convolution, and median filtering, among others. Moreover, its software capablitites can be greatly expanded because it is compatible with the IBM Corp. Personal Computer.

The system also includes a picture display module, a 8088-based CPU with an 8087 floating-point coprocessor and 256-K bytes of RAM, a pair of 360-K-byte floppy-disk drives, a 12-in. monochrome monitor, a black and white or color image display monitor, and the MS-DOS operating system.

The complete digital-image-processing system sells for



$9,895 when ordered in single quantities, with discounts available to original-equipment manufacturers and distributors. Delivery can be expected to take three to four months from receipt of order.

Rabbit Associates Ltd., 4F, No. 400 Keelung Rd., Sec. 1, Taipei, Taiwan, Republic of China. Phone 7020216 [Circle reader service number 440]

Quad op amp features input stage design

Featuring a patented input stage design that allows the input signal to go below the lowest supply voltage without causing phase inversion at the output, the SGS LS404 quad operational amplifier applies novel circuit design to achieve high peformance at reasonable cost.

The LS404's internal compensation allows it to drive highly capacitive loads without compromising stability. This feature is very useful in active filters, as is the unit's symmetrical slew rate, which allows direct coupling of multiple stages.

Featuring low noise (total input noise is only 10 nV/Hz) and low distortion (total harmonic distortion at 1 kHz is 0.04% maximum), the LS404 is available in three packages: a standard plastic DIP, a ceramic DIP for high-reliability applications, and a compact SO-14 micropackage for high-density printed-circuit boards and hybrids.

Prices were unavailable at press time.

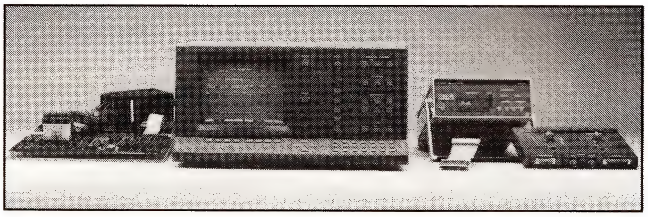
SGS Ates, Via C. Olivetti 2, 20041 Agrate Brianza, Italy.
Phone (39) 39-655-54-21 [Circle 443]

Universal disassembler has automatic synchronization

Enabling the user to define his own disassembly mnemonics, the PM 8850/60 disa-C is a universal disassembly custom package from Philips Test & Measuring Instruments that can hold as many as four user-defined disassemblers.

Designed for microsystems that are not supported by standard disassembler packages, the 8850/60 features full automatic synchronization, which makes the package easy to use. It can be applied to proprietary CPUs such as military chips, commercial CPUs not covered by existing disassemblers, bit-slice implementations, bus systems, and intelligent peripherals.

All required software is incorporated into the package, allowing the user to enter only the bit patterns to be decoded and their mnemonics. The analyzer is set up automatically by the option when any required disassembler is selected.



The 8850/60 offers two types of operation: either straightforward lookup tables (offering 256 entries of 16-bit-wide patterns and eight-character symbolic labels), or complex conditional disassembly (offering qualification on up to 16-bit-wide qualifier patterns and variable-length instructions).

Price for the package is $695 U.S.; the company requires eight weeks for delivery.

Philips N.V., Scientific & Industrial Equipment Division, S&I Press Office, TQIII-4, Eindhoven, the Netherlands.
Phone (040) 788620 [Circle 444]

Display controller works with both CRTs and LCDs

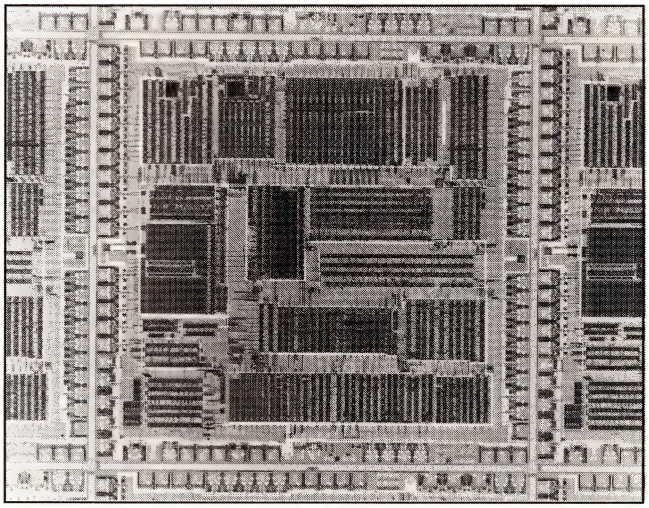
Simplifying display-control circuitry as well as lowering system costs, the V6355 CRT/LCD Display Controller is a single 2-μm CMOS chip. A joint effort involving Microsoft Corp., ASCII Corp., and Nippon Gakki Co., the chip can be used with either monochrome or color CRTs in addition to monochrome LCDs. It features full software and interface bus compatibility with the IBM Corp. Personal Computer.

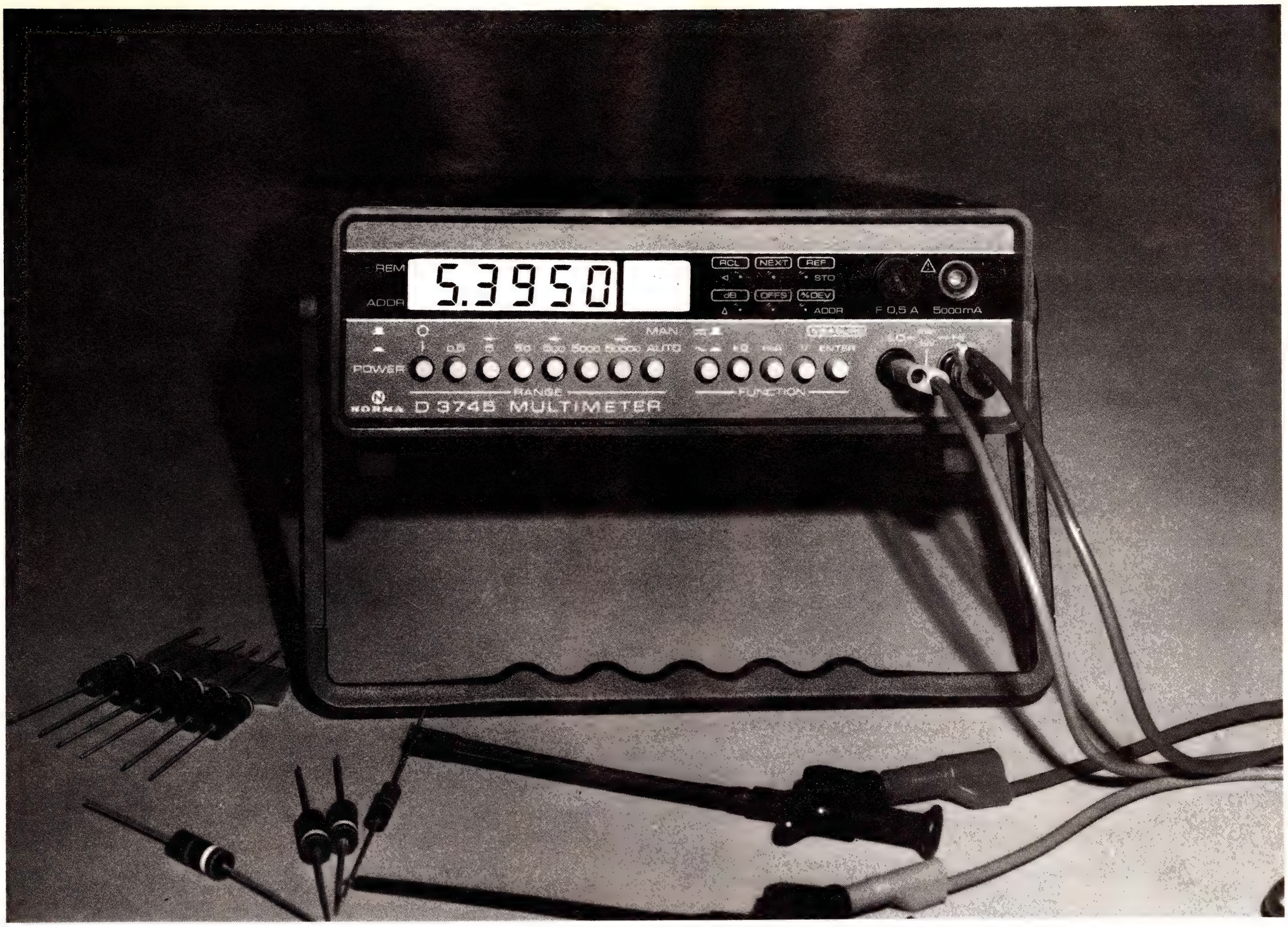
Screen resolutions are user programmable and can be selected from a variety of combinations. Horizontal resolutions can be 640, 512, 320, or 256 dots, and vertical resolutions can be either 192, 200, or 204 dots. Display-control functions include a 16-square-dot user-programmable cursor, and for color monitors the controller can be programmed for any of 512 colors, up to 16 of which can be used at any given moment.

The V6355 boasts a sevenfold reduction in device count, which results in a significant saving of board space. Designed for use in desktop and portable computers, the V6355, which operates in either alphanumeric or graphic mode, measures 646 by 629 mm and is housed in a flat 100-pin package. The controller can be used with either static or dynamic RAM chips for video memory.

The 5-V controller is sample-priced at 10,000 yen.

Nippon Gakki Co., Electronics Systems Division, 203 Matsunokijima, Toyooka-mura, Iwata-gun, Shizuoka-ken 438-01, Japan.
Phone 053962-3111 [Circle 441]





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D 2230	20 nA-200 mA	200 mV-600 V	2 kΩ-2 MΩ
	2 mA-200 mA	200 mV-600 V	
D 3210	200 µA-20 A	200 mV-2000 V	200 Ω-20 MΩ
	200 µA-20 A	200 mV-2000 V	
D 3220 RMS	200 µA-20 A	200 mV-2000 V	200 Ω-20 MΩ
	200 µA-20 A	200 mV-2000 V	
DA 3232	200 µA-20 A	200 mV-(2000 V)	200 Ω-20 MΩ
	200 µA-20 A	200 mV-(2000 V)	
D 3745 IEEE 488	0.5 mA-5 A	0.5 V-1000 V	500 Ω-50 MΩ
	0.5 mA-5 A	0.5 V-1000 V	
D 4025 IEEE 488	250 µA-2.5 A	250 mV-1000 V	25 Ω-25 MΩ
	250 µA-2.5 A	250 mV-1000 V	
D 4045 IEC 625	250 µA-2.5 A	250 mV-1000 V	25 Ω-25 MΩ
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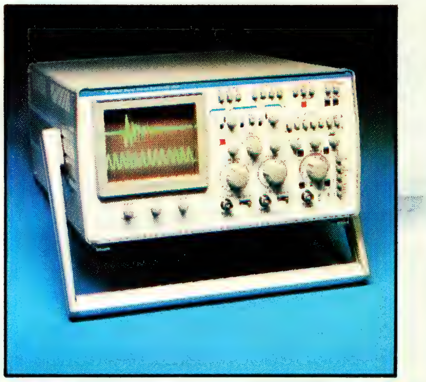

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NEW PRODUCTS

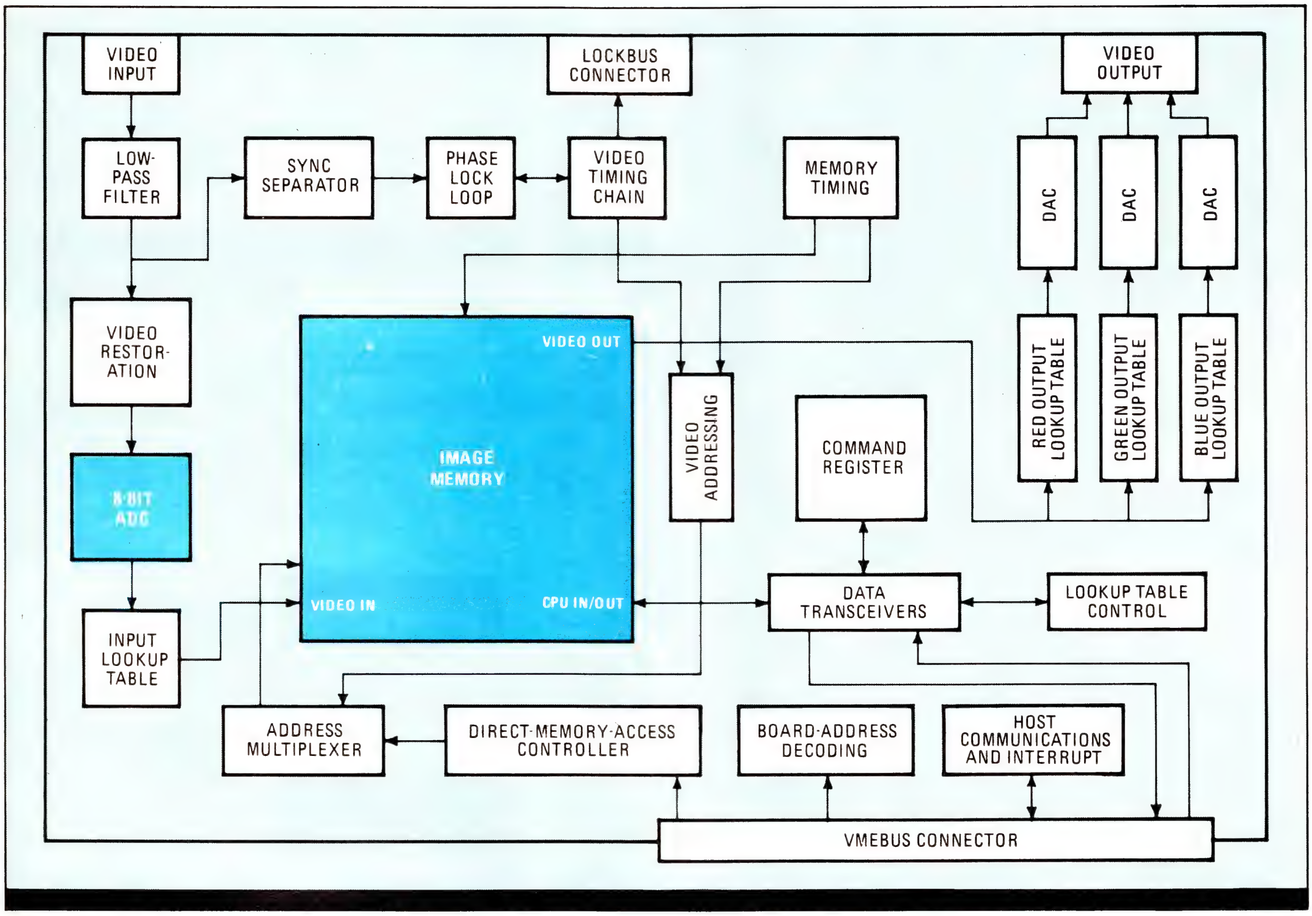
VME DESIGN IMPROVES IMAGE

A VME-based board performs video acquisition, storage, and display tasks to give sight to automated factory equipment

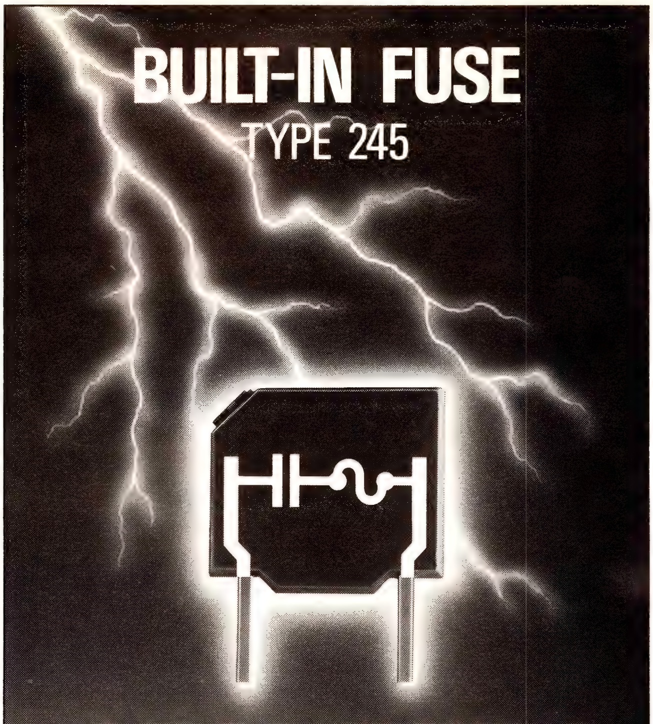
☐ *by Tobias Naegele*

Real-time imaging products can substantially affect factory automation—robotics, machine vision, quality control, and the like. Increased efficiency, accuracy, and overall quality are all potential benefits of the union of these technologies.

A rugged factory environment, however, is hard on imaging products. Dust, dirt, and vibration inherent to the workplace all pose a constant hazard to sophisticated equipment. The first video-acquisition, frame-storage, and display system built on a single VME-based board, Datacube Inc.'s VVG-128, is designed to run under these very conditions on the factory floor. Datacube marketing manager Susan Snell Solomon cites the board's pin-and-barrel construction as an example of its design for protection from vibrations. The compact design—the VVG-128 occupies an estimated one half to one third the board



What you see is what you get. Datacube's VVG-128 is a complete video- acquisition, frame-storage, and display system built on a single VME board. Designed to weather the abuses inflicted by the harsh factory environment, the board has perfect resolution with most CDC cameras.



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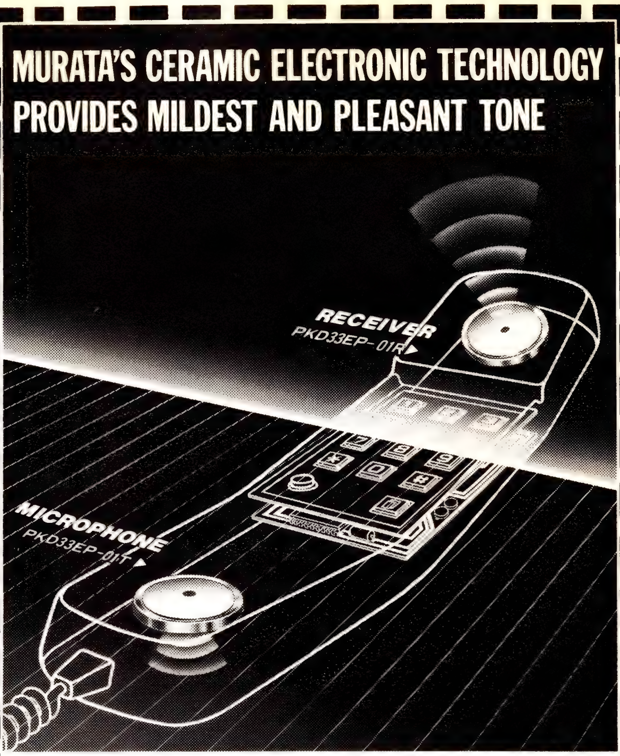
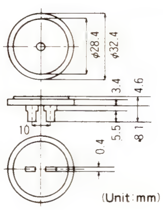
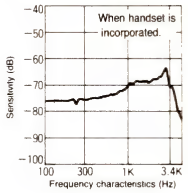


● Uses ultra-thin piezo ceramic element. ● Low freq. 0.3-3.4 KHz. ● Directly driven by ICs at high impedance. ● Least degradation during services ● Compact-size and lightweight.

● External dimensions

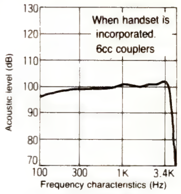


● Sensitivity & Freq. characteristics (Microphone)



〈Specifications〉
- Sensitivity: -73dB (0dB = 1V/0.1Pa)
- Capacitance: 55nF (at 120Hz)
- Frequency range: 0.3~3.4KHz

● Acoustic level & Freq. characteristics (Receiver)



- Acoustic level: 105dB
  (1-Vrms 1KHz 6cc coupler)
- Capacitance: 55nF (at 120Hz)
- Frequency range: 0.3~3.4KHz
- Input voltage: 30Vp-p max.

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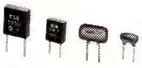
CERALOCK®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Murata provides series of (CERALOCK®) ceramic resonator designed for use with microcomputers.

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The CLS-37S also costs less to operate. Designed as "the smart laser trim system," it uses a unique "distributed intelligence" concept designed specifically for the laser trim industry. So easy and fast to program, you and your staff can learn to program the CLS-37S in just days.

In addition to its well-earned reputation for high-speed and accurate passive trimming, the CLS-37S has a full range of standard options to handle all your thick film trimming needs. These include AC, high-accuracy DC, Time Measurement (phase, frequency, period), Capacitance Matrix, Dual Voltage Source, Extended Stored Data and IEEE Interface.

Every Chicago Laser Systems trimmer must meet rigid quality-control standards, passing extensive performance and burn-in tests. The chances of downtime are further reduced by the ease of maintaining the system. Should a fault occur, it can be rapidly isolated with the systematic diagnostic programs provided.

Circle 105 on reader service card

Above all, the CLS-37S is a high volume production system that will increase worker productivity and trim the cost of laser trimming. With an available air-bearing step and repeat handler, it trims over 250,000 resistors per hour. An automatic stack load/unload station is also available.

For a detailed appraisal of how the Smart Laser Trim System can fill your needs, contact Chicago Laser Systems.

Chicago Laser Systems Inc.

4034 N. Nashville Ave., Chicago, IL 60634 • Phone 312 • 282-2710 Telex: 671-1269

real estate of comparable systems—also adds protection.

Featuring a host CPU for the generation, analysis, processing, storage, manipulation, and retrieval of images, the 6-by-9-in. double-height board can digitize and display one frame of standard RS-170 (60 Hz, interlaced) or European standard (50 Hz, interlaced) video in real time (1/60 s).

The VVG-128 has a perfect pixel-to-pixel resolution with most charge-coupled-device cameras, eliminating the need for image compression. Low- and medium-resolution vidicon-tube cameras may also have precise resolution matches, although the higher-resolution cameras would likely require compression of the image.

Its 192-K bytes of fully transparent on-board image memory are configured as 384 by 512 pixels by 8 bits deep. The screen's display, however, measures 384 by 485 pixels, with the remaining 27 lines hidden off screen. The user must scroll to see the hidden portion.

The VVG-128 accepts and digitizes raw video signals through a 75-Ω on-board connector; the signal is then dc-restored and applied to a specially designed flash analog-to-digital converter running at a 7.16 MHz rate. The converter, designed by TRW Inc., delivers its output to a high-speed RAM-based input lookup table capable of transforming any digital gray value into any other 8-bit value under program control.

Output is next forwarded to the triple-ported video memory and fed on a continuous basis to three output lookup tables that drive a trio of high-speed digital-to-analog converters, whose outputs are intended to drive the video inputs of color monitors. The output lookup tables are capable of translating 256 gray values in memory into any 256 of 16 million possible colors.

Cascading three VVG-128s offers true-color capabilities as opposed to the simulated color provided by a single board. With the three-board configuration, which the company calls the lockbus, the board becomes a valuable tool in the testing of color-coded parts produced on a production line. Within the lockbus, each board is assigned a color—red, blue, or green—and together they can digitize a full-color image from a color camera. The lockbus also triples the number of possible tonal or color values from 256 to 768, because the depth of each pixel is tripled to 24 bits.

Both the input and output lookup tables can be bank-selected under software control. Other on-board functions under host-software control include the input video digitizing and an internal crystal reference or phase-locked synchronization source to to an external composite video source. The company provides access to all standard software packages for all board functions and diagnostics.

The VVG-128 is priced at $2,995 for quantities up to nine, less in greater quantities. The three-board lock-bus is $7,000 complete, again with discounts for orders greater than nine. Original-equipment-manufacturer discounts are available, and delivery can be expected 30 days after receipt of order.

Datacube Inc., 4 Dearborn Rd., Peabody, Mass. 01960. Phone (617) 535-6644 [Circle reader service number 338]

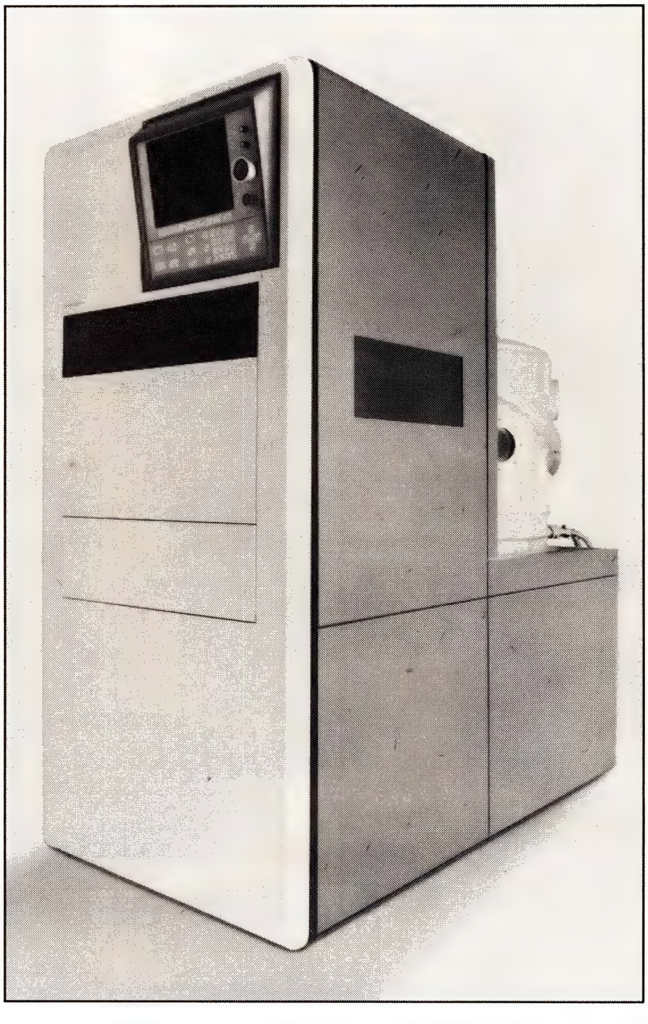
Advanced plasma etcher minimizes contamination

A second generation of reactive-ion-etch systems for the production of 6-in. semiconductor wafers features a robotic arm designed to minimize handling during processing. A plasma-etching system, the Precision Etch 8300, is based on the hexode design approach developed for the AME 8100 series released in 1981.

Operating within a vacuum, the arm is used to load a batch reactor, protecting the process chamber and wafer from particulate contamination. Its hexode design and 18-wafer capacity offer high throughput potential.

In addition, the etcher's low chamber pressure (less than 100 mTorr) increases the precision with which it cuts circuit patterns, and its radio-frequency and gas distribution system makes for wafer-to-wafer uniformities of as little as ±5% when using fluorinated chemistries for etching dielectrics. Its through-the-wall design keeps maintenance outside the clean room, for further protection against contamination.

Priced at about $675,000, Precision Etch 8300 systems with an aluminum etch process will be available immediately, while other configurations for etching polysilicon and a variety of refractory metals and their silicides will



become available over the course of the year.

Applied Materials, 3050 Bowers Ave., Santa Clara, Calif. 95051. Phone (408) 727-5555 [Circle 340]

Plasma stripper runs at low frequency

Designed to strip photoresist in the production of high-resolution ICs and thin-film hybrids, Mercator Control's model LF-5 low-frequency plasma system is also capable of surface cleaning and treatment, organic ashing, and material analysis.

The unit is equipped with a vacuum system, a dual-gas-introduction system, an aluminum reactor chamber, a 500-W radio-frequency generator, a process timer, and an end-point detector. The LF-5 has digital readout of all process parameters and functions.

The LF-5 sells for about $25,000 and can be delivered in about 30 days.

Mercator Control Systems Inc., P.O. Box 10020, Santa Ana, Calif. 92711. Phone (714) 973-2074 [Circle 342]

Compact sputter coater offers size flexibility

Convertible convenience is the primary advantage of the model 203 Sputter Coater now being offered by Materials Research Corporation.

Based on the model 202, which was designed for 4-in. and 5-in. wafers, the 203 can also be configured for 6-in. wafers and is convertible from one size to another within a matter of hours, the company says.

Capable of producing 30 wafers/h for aluminum and aluminum alloys, the 203 is a compact unit, with a footprint of just 30 by 40 in. It is available with options including radio-frequency sputter etch and rf bias.

Priced at $230,000, the 203 requires 120 days for delivery.

Materials Research Corp., Rte. 303, Orangeburg, N.Y. 10962. Phone (914) 359-4200 [Circle 341]

Flexible IC combines standard cells, gate arrays

Employing a structure dubbed the soft macro, the Flexx array offers both gate arrays and standard cells on the same chip. The company says its soft macro gives design engineers total circuit-design flexibility, which results in 100% silicon efficiency—no gates are wasted.

The Flexx array IC could replace up to 100 small- and medium-scale integration ICs, the company says, and because only those gates and I/Os required for a specific application are implemented in silicon, both final chip size and cost can be minimized.

The first model of the Flexx array, available immediately, uses an oxide-isolated integrated Schottky logic process. The two-metal process provides a typical per-gate propagation delay of 900 ps and gives designers the capability to create application-specific designs of up to 2,000 gates. To achieve gate counts of up to 6,000 and per-gate propagation delays of 2 ns, the company in June plans to make available a two-level metal, 2.5-μm CMOS process.

Prices vary according to chip size and package options. Nonrecurring engineering charges, which include a four-day training class, 125 min of CPU time for circuit simulation, placement, and routing of the circuit, and 50 prototypes, cost from $19,000 to $30,000 per design. Production pricing runs from about $18 to $35 each, depending on volume.

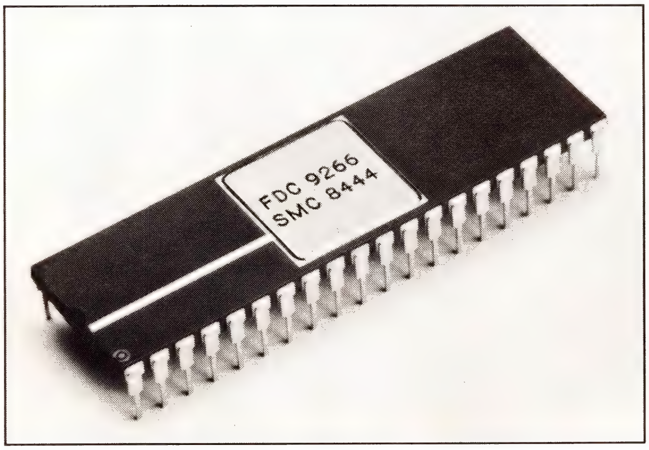
Signetics Corp., 811 E. Arques Ave., P.O. Box 409, Sunnyvale, Calif. 94086. Phone (408) 739-7700 [Circle 352]

Floppy-disk controller runs up to four drives

Combining a controller chip, precompensation logic, and a patented digital data separator into one 40-pin package, the FDC 9266 enhanced floppy-disk controller boasts low chip count and high cost effectiveness.

The FDC 9266 can control up to four drives in both single and double density; it can handle single- or double-sided 3½-, 5¼-, or 8-in. drives.

By incorporating all of the data-separation components on the floppy-disk controller, its digital data separator



Hitachi's HD63484 blazes onto the scene with exceptional colors, control and speed for your CRT applications —another unique product of Hitachi technology.

NO MORE JERKY SCROLLING OR SLOW-MOTION PAINTING;
HITACHI'S ADVANCED CRT CONTROLLER OFFERS
COLORS AND SPEED THAT ARE ABSOLUTELY

BLAZING

At last there is a one-chip graphics controller that combines advanced bit-mapped graphics and alphanumerics to put screen control outside the MPU, where it belongs. It's the HD63484 ACRTC from Hitachi—the world's first Advanced CRT Controller for high-power visual interface and amazingly fast display capabilities.

Total Drawing Control, Plus 65,536 Colors

Drawing commands are stored on-chip for instant imaging of circles, lines, ellipses, polygons, dots, arcs, and such previously complex functions as painting, patterning, construction of filled rectangles...38 commands in all. That means tremendous simplification of programming and reduction of software development costs. In fact, a screen-centered circle can be drawn and divided into four quadrants painted in different colors in just 21 commands!

Screen control is also enhanced to the maximum. The ACRTC allows three horizontal split screens and a free-floating window for combination in a wide variety of ways. The "smooth scroll" feature operates independently in both the horizontal and vertical modes for movement so continuous it's comparable to video-taped action. And a zoom-in display function is included, too, for enlarging images from 1 to 16 times.

What's more, the ACRTC can handle precision color mixing for an astounding 65,536 different tones. And as for speed and memory capacity, it can actually draw at a maximum rate of 2 million pixels per second when clocked at 8 MHz, and address up to 2 megabytes of separate bit-mapped graphics plus 128 kilobytes of character data. That's high performance guaranteed, no matter how dense the display required.

Ready for Immediate Application

This is your opportunity to make use of trail-blazing technology in office terminals, CAD/CAM equipment, graphic displays, arcade game machines, sophisticated personal computers and other applications calling for faster, more powerful imaging control. The ACRTC can even be applied in laser beam printers.

And best of all, it's the product of Hitachi's innovative CMOS technology—renowned throughout the world for high quality and top reliability. When you're ready for blazing speed and blazing colors in your displays, make way for the HD63484 Advanced CRT Controller—only from Hitachi.

HITACHI

For more information:
Hitachi, Ltd., Semiconductor & IC Div., New Marunouchi Bldg., 5-1 Marunouchi 1 chome, Chiyoda-ku, Tokyo 100, Japan Tel: Tokyo (03) 212-1111
Hitachi Electronic Components Europe GmbH, Hans-Pinsel-Strasse, 10A, D-8013 Haar/Munich, W. Germany Tel: 089-46140
Hitachi Electronic Components (U.K.) Ltd., HITEC House, 221-225 Station Road, Harrow, Middlesex, HA1 2XL, United Kingdom Tel: 01-861-1414
Hitachi Electronic Components (Asia) Ltd., Unit 512-513, World Finance Centre-Harbour City, North Tower Canton Road, Tsim Sha Tsui, Kowloon, Hong Kong Tel: 3-7219218
Hitachi America, Ltd., Semiconductor & IC Sales & Service Div., 2210 O'Tool Avenue, San Jose, CA 95131, Tel: 408-942-1500

Circle 82 on reader service card

saves board space, a feature that also avoids use of critical tuning and precision analog components necessitated by anolog designs.

The unit allows for easy interfacing to existing operating systems and conforms to IBM Corp. standards for both single- and double-density formats. Additionally, the FDC 9266 works in direct-memory-access, processor-polled, or interrupt modes, affording the system designer the option of choosing the best mode for the given application.

A built-in precompensation generator allows the user to select from 14 different compensation values between 0 and 625 ns. Available in both plastic and Cerdip 40-pin DIPs, the FDC 9266 requires a single +5-V power source.

Delivered from stock, its price is $25.30 per 100 pieces.

Standard Microsystems Corp., Standard Products Marketing, 35 Marcus Blvd., Hauppauge, N.Y. 11788
Phone (516) 273-3100 [Circle 353]

Shift registers are compatible with CMOS and TTL designs

Complete with three-state I/O lines, the CD54HC299 and CD54HCT299 universal 8-bit shift registers operate in four synchronous modes controlled by two mode-select input lines.

The HC model shift registers are intended for low-power, high-speed CMOS designs; the HCT version is pin-, function-, and speed-compatible with standard low-power Schottky TTL.

In operations requiring more than 8 bits of data, the parts can be cascaded. A synchronous master reset is provided, which clears the register when low, regardless of other control inputs.

Supplied either in 20-lead, hermetic ceramic DIPs (designed to operate over the full military temperature range of –55° to +125°C) or in plastic 20-lead DIPs (operable from –40° to +85°C), both types are also available as chips or wafers.

The input voltage for the HC ranges from 2 to 6 V dc, while the HTC versions operate from voltages between 4.5 and 5.5 V dc. Plastic-packaged HC registers are priced at $3.35 each in lots of 100 pieces and HCT models run $2.39 each per 100. Ceramic-packaged HC models are listed at $5.02 each per 100 pieces, and the ceramic HTCs are $4.13 each per 100.

RCA Corp., Solid State Division, Route 202, Somerville, N.J. 08876. Phone (800) 526-2177 [Circle 354]

Buffered display system shows off 20 characters

The 2000B series of alphanumeric displays features a voltage converter with a display controller that performs all timing, control, refresh, and character-generation functions.

The buffered display interfaces to a host processor that can provide data in series or parallel 8-bit format. The 20-character, 5-by-7 dot-matrix display comes in heights of 0.20, 0.35, and 0.59 in. Options include a serial RS-232-C or current-loop port, a Centronics-compatible parallel printer port, and a Schmitt trigger input for protection from voltage transients. The display is supplied as a single board, with a piggyback interface board, with an attached bezel, or in a panel-mount case.

Prices for a single unit range from $175 for the 5-V, 0.20-in. character-height model 2005B to $335 for the 2015B, which operates from 120 V and displays characters 0.59 in. high in a case.

Vorne Industries Inc., 5023 W. Belmont Ave., Chicago, Ill. 60641
Phone (312) 725-3077 [Circle 375]

Digital panel meter is thrifty with space

With a thickness of 1/3 in., the BL100 Big-Little digital panel meter offers a ½-in. 3½-digit display within an area of 0.945 by 2.36 in. Manufactured in surface-mounted CMOS hybrid technology, the BL100 has input ranges of ±200 mV or ±2 V and is accurate to 0.1% of reading. It has input protection, ratiometric operation, automatic polarity, and power options of ±5 V dc, +5 V dc, and 9 V for battery power operation.

A low component count combined with no external components or circuitry means reliability, the manufacturer says. The case, designed with a shoulder, can be flush-mounted through a window in the panel. Or to save space, the unit can be directly mounted on the front. Electrical connections are made with wire-wrapped pins or standard 13-pin connectors.

The BL100 digital panel meter is priced under $30 in original-equipment-manufacturer quantities (single units range from $40 to $45, depending on options). Small-run quantities are available now, with full-scale production scheduled for May 1.

Modutec Inc., 18 Marshall St., Norwalk, Conn. 06856.
Phone (203) 853-3636 [Circle 379]

Eight-color graphics printer sells for less than $2,000

A matrix printer combining eight-color graphics and three levels of text printing, the Model 1310 Color Graphics Printer is software-compatible with the IBM Corp. Personal Computer.

Also designed for use with Lee Data's Series 70 Personal Workstation, the 1310 can print eight-color images

of personal computer graphics as well as those produced by a mainframe computer. As a text printer, the 1310 has three operating speeds: letter quality (at 35 characters/s), correspondence quality (at 110 c/s), and draft quality (at 200 c/s).

Using appropriate software for the personal work station, the printer can produce documents with color business graphics and text. Charts and graphics can be designed using software compatible with the IBM PC.

The printer is priced at $1,960 and is available for immediate shipment.

Lee Data Corp., 7075 Flying Cloud Dr., Minneapolis, Minn. 55344. Phone (612) 828-0300 [Circle 343]

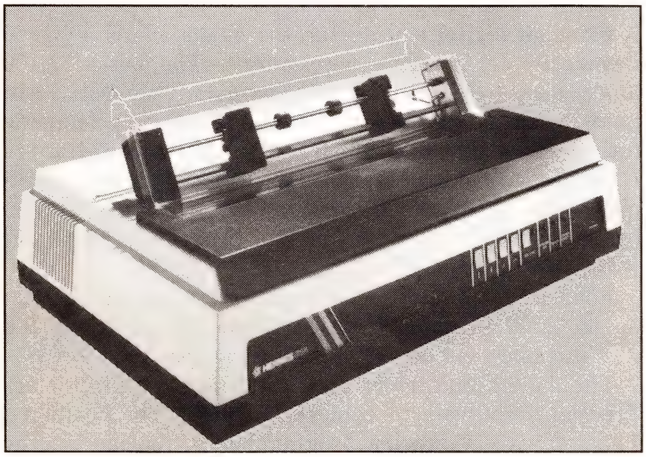
Eight-color printer can handle 600 c/s

Fast and reportedly compatible with a wide range of computers, the Hermes 615 Color Printer can print up to 600 characters/s in the draft mode and up to 150 c/s in its correspondence mode.

Using a unique "moving ruby" printhead that produces correspondence-quality print in a single pass, the eight-color printer is compatible with nearly all computers on the market today, according to the company, which is based in Switzerland.

The 615 printer, which offers a variety of interfaces and paper-handling devices, is priced at $2,695 and is being marketed through computer-product distributors under the direction of the company's newly created Printer Division.

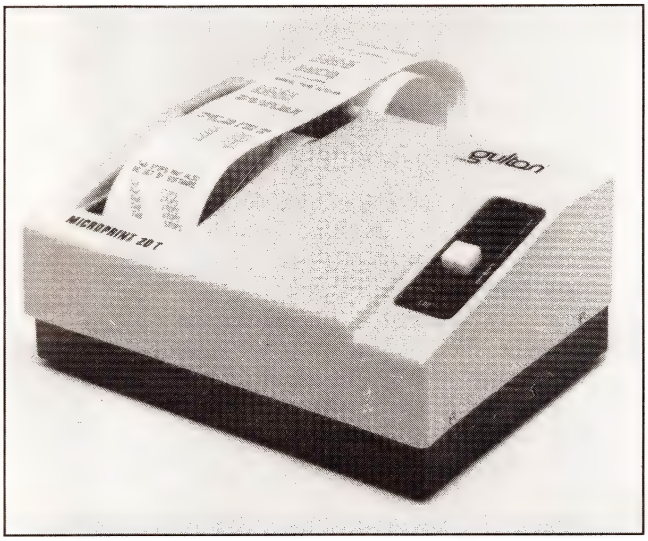
Hermes Precisa International, Printer Division, 1900 Lower Rd., Linden, N.J. 07036. Phone (201) 574-0300 [Circle 344]



Stand-alone thermal printer puts out 2 lines/s

A fully programmable thermal printer that can process copy in a 20-column text format faster than two lines per second, the Microprint-20T is designed for use with microprocessor-based data systems.

The tabletop printer uses a fixed-head linear design and offers a choice of either a 5-by-7 or 5-by-14 dot-matrix character. Operators can also select from a variety of formats through software commands, and half-sized and enhanced print fonts are available.



The MP-20T features a data buffer of one 20-character line, four print fonts, programmable tab settings, built-in self-test, and backspacing. It recognizes the 64-character ASCII set, including control commands. International character sets are optional.

Offering both a parallel seven-bit interface and a serial RS-232-C interface, the MP-20T costs $650 per unit, with discounts available for original-equipment manufacturers on large-volume orders. The printer is available immediately.

Gulton Industries Inc., Graphic Instruments Division, East Greenwich, R.I. 02818. Phone (401) 884-6800 [Circle 345]

ADCs guaranteed accurate to 1.5-μs conversion time

Guaranteed to meet all minimum and maximum specifications, a line of high-speed analog-to-digital converters features 16-bit accuracy and up to 1.5-μs conversion time. The A/D/A/M-826 family of ADCs is available in three configurations.

The 826-1 features a fast and accurate sample-and-hold amplifier capable of producing a complete acquisition and conversion in 2.3 μs. The 826-2 possesses a 100-MΩ input-impedance buffer amplifier with full-scale settling within 400 ns, yielding an overall conversion rate of 500 kHz. The unbuffered 826-3 is the fastest of the three new ADCs, claiming the world's fastest conversion time, according to the manufacturer—1.5 μs.

All three parts have a code differential nonlinearity of ±¼ least significant bit, and differential linearity is stable over temperature. They are guaranteed to have no missing codes and are shipped with their complete test documentation. Their temperature coefficient is better than ±1 ppm/°C.

The modules, priced at $966 per 100 units, dissipate power at the maximum rates of 3.25 W for the 826-3 to 4.5 W for the 826-1.

Analogic Corp., 8 Centennial Dr., Centennial Industrial Park, Peabody, Mass. 01961. Phone (617) 246-0300 [Circle 346]

16-bit hybrid ADC converts with no missing codes

Billed as the fastest 16-bit hybrid analog-to-digital converter specified over the full commercial temperature range, the AD376 guarantees no missing codes to 14-bit accuracy from 0°C to 70°C.

The ADCs, which boast a conversion time of 17 μs (15 μs when short-cycled to 14-bit resolution), are hermetically sealed in a 32-pin metal DIP for added protection against harsh environments. In addition, its proprietary chips result in lower noise, the company says, and therefore increased reliability through reduced chip count.

Available in two grades, the AD376 accepts bipolar input signals of ±2.5 V, ±5 V, and ±10 V, as well as unipolar inputs of from 0 to 5 V, 0 to 10 V, and 0 to 20 V. The converters are specified for operation with ±15 V dc and +5 V dc power supplies; typical power consumption is 1,100 mW.

Priced from $189 per 100 for the AD376JM to $219.50 per 100 for the AD376KM, production quantities require six to eight weeks for delivery.

Analog Devices, Microelectronics Division, Rte. 1 Industrial Park, P.O. Box 280, Norwood, Mass. 02062 [Circle 347]

Hybrid ADC is linear to within 0.0008%

The military grade HS 9516 hybrid analog-to-digital converter, with a linearity rating of ±0.0008%, has a standard conversion time of only 100 μs.

Guaranteed to have no missing codes to 16 bits from 0°C to 70°C and no missing codes to 14 bits in the more extreme temperature range of –55°C to +125°C, this ADC contains a clock-control input that allows users the option of decreasing conversion time to just 30 μs while reducing output accuracy to ±0.003% of full scale.

Accepting analog unipolar voltages of 0 to 5 V, 0 to 10 V, and 0 to 20 V and bipolar voltages of ±2.5 V, ±5 V, and ±10 V, the HS 9516 delivers output data in either parallel binary or 2's complement format and is offered in three grades.

Prices per 100 pieces are $389 for the 14-bit HS 9516-4, which has ±0.003% linearity; $439 for the 15-bit HS 9516-5, with ±0.0015% linearity; and $499 for the 16-bit HS 9516-6, with ±0.0008% linearity.

Delivery takes four to six weeks after ordering.

Hybrid Systems Corp., 22 Linnell Circle/Suburban Industrial Park, Billerica, Mass. 01821. Phone (617) 667-8700 [Circle 348]

Arbitrary waveform generator allows visual wave editing

With a technique called rubberbanding, the model 75 arbitrary waveform generator can stretch or compress custom waves viewed on an attached oscilloscope. Like a rubber band stretched between thumbtacks, the wave is anchored at its ends and can be edited in real time by a cursor. The generator also can link multiple waveforms.

Waveforms have a vertical resolution of 4,096 points and a horizontal resolution that is adjustable from 2 to 8,192 points. The waveform memory is broken up into four blocks of 2,048 points, so four different waveforms of up to 2,048 points can be in memory at any one time.

The sample period is crystal controlled and adjustable from 500 ns to 50 s. Memory is battery-backed for indefinite waveform storage.

Custom wave applications include production testing of medical electronics products such as pacemakers, which depend on abnormal waveforms. Physical materials testing can also use customized waveforms.

Scheduled for release in late February, the generator will cost less than $2,000.

Wavetek, 9045 Balboa Ave., San Diego, Calif. 92123.
Phone (619) 279-2200 [Circle 355]

Systems DMM has nine measurement functions

A 6½-digit digital multimeter, the model 193 is designed specifically for systems applications. The basic $2,100 model measures dc voltage, two-wire and four-wire resistance, decibels, resistance-temperature detector temperature linearization, and low-frequency ac from 0.1 to 10 Hz. Optional measurement functions include true root-mean-square ac voltage (option 1930 for $245), dc amperage (option 1931 for $230), and true-rms ac amperage with both options 1930 and 1931.

Four scale resolutions are available with reading rates up to 1,000 readings/s at 3½ digits. Sensitivity is 100 nV, and one-year dc-voltage accuracy is within 0.009%.

The digital multimeter uses the company's proprietary Translator software to achieve IEEE-488 bus flexibility. The software allows the programmer to replace lengthy

commands with shorter mnemonics. The shorter commands are more recognizable to the user and also reduce bus traffic.

The instrument will be available in mid-1985 and takes 8 to 10 weeks for delivery.

Keithley Instruments Inc., 28775 Aurora Rd., Cleveland, Ohio. 44139. Phone (216) 248-0400 [Circle 356]

1-K-by-9-bit CMOS FIFO has access time of 50 ns

With a 1-K-by-9-bit organization, the 7102 CMOS Parallel In-Out first-in, first-out memory offers a commercial access time of 50 ns. The military version accesses in 55 ns. The FIFO uses a RAM pointer architecture that eliminates fall-through time and allows a faster read-write cycle. The chip uses full, empty, and half flags to prevent data overflow and underflow. It also uses expansion logic to allow for unlimited expansion in both word size and quantity.

The commercial part requires 80 mA and the military unit demands 100 mA. They are packaged in a 28-pin ceramic DIP or a 32-contact leadless chip carrier. Military models are 100% screened to MTL-STD-883 Class B, method 5004.

The commercial 7202 sells for $155 in quantities of 100 or more. The military 7202L55CB lists for $434 for quantities of 100 or more.

Integrated Device Technology Inc., 3236 Scott Blvd., Santa Clara, Calif. 95054. Phone (408) 727-6116 [Circle 357]

64-K bipolar PROM accesses in 40 ns

A proprietary scaled, ion-implanted, oxide-isolated bipolar process gives the 27S49A 64-K PROM a guaranteed maximum access time of 40 ns. The part is suited for microprogrammed control store memory applications for microprocessors. The company's process allows the 8-K-by-8-bit density as well as the rapid access time. The PROM incorporates three-state outputs, and features platinum-silicide fuses.

The 27S49 is packaged in a 24-pin 600-mil ceramic package. The 40-ns device sells for $108 in 100-piece quantities. A 50-ns version is also available for $72.50 in orders of 100 or more. A military version is expected by the second quarter of this year.

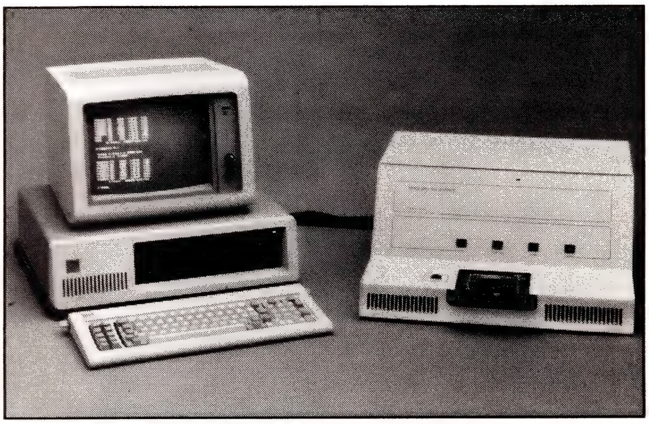
Advanced Micro Devices Inc., P.O. Box 3453, Sunnyvale, Calif. 94088. Phone (408) 749-5157 [Circle 358]

Circuit testers are based on IBM PCs

A series of IC test systems is controlled by IBM Corp.'s Personal Computers. The model 1000 digital tester is based on the PC AT version, while its equivalent, the 1005, is based on the PC/XT. The 1010 linear/digital test system is PC AT-based and its equivalent, the 1015, is PC/XT-based. In addition to testing, the PCs can be used to run any compatible software.

The 1000/1005 systems offer three programmable power supplies, 24 bidirectional digital pin drives with 0- to 20.48-V drive and sense, full Kelvin sensing on all pins, and burst clock generator. Options include an ECL test adaptor, a CMOS stress adapter, and a gauged-input leakage-test adapter.

The 1010/1015 linear/digital testers offer a 16-bit measurement system, four programmable and three fixed power supplies, programmable ac function generator, programmable clock generator, root-mean-square voltmeter, a programmable 16-bit reference supply, 10.0000-V voltage reference, 28-pin analog matrix, 22 digital pin drivers, 11 relay drivers, and a number of options.



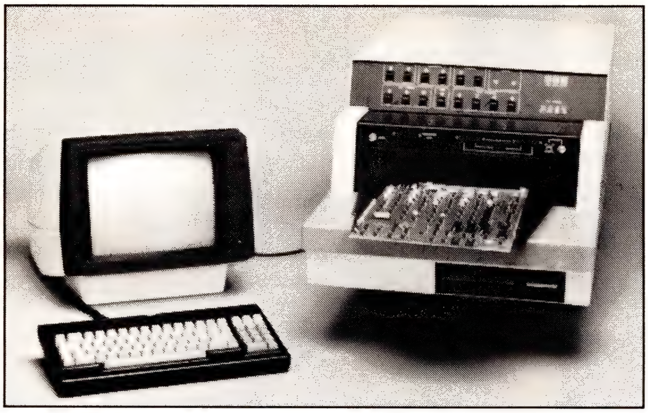
The test systems are intended for production testing, incoming inspection, and laboratory use. The systems are programmed by Pbasic, an extension of Basic used for testing. Prices, including the PCs, are $35,960 for the 1000, $27,950 for the 1005, $49,950 for the 1010, and $42,950 for the 1015.

Pragmatic Test Systems Inc., 1405 S. Milpitas Blvd., Milpitas, Calif. 95035. Phone (408) 943-1920 [Circle 359]

Portable device tests entire board at speed

An automatic functional digital board-testing system provides at-speed pass/fail testing of complex systems such microprocessors, ROM, and RAM. The model TL-88 can not only isolate faults to the nodal level, it can also serve as a development station for software; the interactive commands are presented in menu format and include those for fault simulation and IEEE-488 bus control.

The system weighs 80 lb and has built-in handles to facilitate portability. Performance features include a data-



pattern rate of 10 MHz, a driver/sensor pin capacity expandable to 256, and a rotatable indexing test head.

The basic price is $39,950 and it is deliverable in two to three months.

Trace Data Systems Inc., 1170L Burnett Ave., Concord, Calif. 94520. Phone (415) 798-7831 [Circle 360]

Power MOS FETs target telephone-system tasks

Operating in the depletion mode, the DWB100 series of power MOS FETs provides an advantage in applications such as telephone systems, where a large percentage of loop circuits are normally closed until the subscriber sends a signal to the system.

Two n-channel devices in the series, the DWB120 and DWB110, are rated at 200 V and 300 V, respectively, with a maximum on-resistance of 20 and 30 Ω. The devices are capable of continuous currents up to 200 mA and dc pulse currents to 1 A. All units are fabricated by the DMOS process, and therefore can handle voltage-current combinations on a chip smaller than those built under junction-FET technology while keeping off-state leakages under 10 μA.

Initially offered in a TO-5 case with other packages available, the parts are priced at $1.75 each for the DWB120 and $2.75 each for the DWB110, in lots of 1,000. Samples are available from stock in two weeks, and quantity orders will be delivered in four to six weeks.

Theta-J Corp., 8 Corporate Place, 107 Audubon Rd., Wakefield, Mass. 01880. Phone (617) 246-4000 [Circle 361]

Op amps make minimal power demands

In data logging, temperature control, and medical instrumentation, the TSC900 chopper stabilized operational amplifier is specified for battery operation or other applications where a minimal power supply is available. The A version of the TSC900 features 200-μA maximum supply current, 5-μV maximum offset voltage, and 0.05-μV/°C maximum offset voltage drift; the B version is specified at 400-μA supply current, 15-μV offset voltage, and 0.3-μV/°C offset voltage drift.

Both devices are offered in 8- and 14-pin plastic and ceramic DIPs, and beginning in April 1985, they can be ordered with a 160-h, +125°C burn-in. In 100-piece lots, pricing goes from $4.10 to $6.10, and delivery will be made in six to eight weeks.

Teledyne Semiconductor, 1300 Terra Bella Ave., Mountain View, Calif. 94043. Phone (415) 968-9241 [Circle 362]

Multimode fiber-optic system needs no repeaters

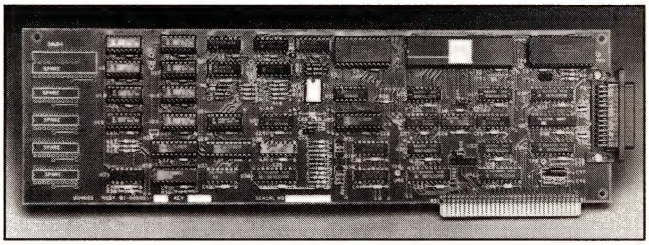
Single-mode fibers with an optic core of only 8 μm, plus long-wavelength (1,300 nm) lasers create a fiber-optic system that transmits analog video signals over 20-mile-long links without intervening repeater stations. The SL3000L's bandwidth is 20-MHz wide, allowing simultaneous transmission of wideband video carriers and audio and data subcarriers.

Automatic protection options available for the SL3000L include the A3400 automatic-protection switch, which automatically switches over to a standby channel in the event of a failed module or fiber break. In addition, the system can also be configured to shut down when a drop in received optical power indicates the presence of an intruder.

Artel Communications Corp., P.O. Box 100, West Side Station, Worcester, Mass. 01602. Phone (617) 752-5690 [Circle 364]

Data-communications board is certified for varied nets

Telenet's certified X.25 controller chip is the foundation of the WD4025 data-communications board, which has also been certified by Tymnet and Uninet networks in the U.S. and by the Datex-P network in West Germany. Certification assures systems integrators using the board that the link level of their product will meet these networks' data-transmission requirements.



The controller accords with IBM Corp.'s Personal Computer, PC/XT, PC AT, and their compatibles, building links to a variety of systems including public data networks. With software, the large-quantity price is $695.

Western Digital Corp., 2445 McCabe Way, Irvine, Calif. 92714. Phone (714) 863-0102 [Circle 366]

Communications processor seizes low-tariff advantage

Supporting transmission rates of up to 2,048 kb/s, the 4705T communications processor takes advantage of the new lower tariffs offered by common carriers for high-

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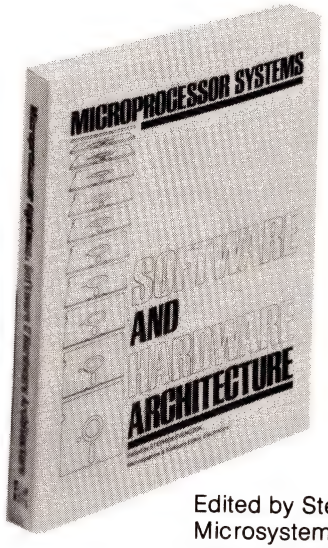

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speed lines. The Systems Network Architecture-compatible 4705T lets operators mix voice, video, and data at speeds of up to 768 kb/s from multiple applications for efficient use of the communications bandwidth.

Prices for the 4705T communications processor begins at $42,000, and two- and four-year leases are also available. Both those who own and lease the model 4705 will be able to upgrade it to a 4705T. Models will be available in the first quarter of this year.

Amdahl Corp., 1250 E. Arques Ave., P.O. Box 470, Sunnyvale, Calif. 94086. Phone (408) 746-6000 [Circle 365]

Simulation package runs through circuit in 3 min

Circuits of up to 300 transistors can be displayed immediately and run in 3 min with an algorithm created for MOS and CMOS circuits. The algorithm is the core of a circuit simulator called Simon, whose other very large-scale-integration applications include gate arrays and standard library cells as well as circuits with convergence problems.

Whole-chip simulation (up to 50,000 transistors) and large-circuit simulation (more than 1,000 transistors) have been performed with Simon running on work stations. Simon runs on a number of host computers and work stations, and it will accept Spice-coded models and network files as input.

Output formats include printing and plotting, and information on individual nodes; user-defined logical output is also an alternative. The price of Simon depends on the installation and the CPU. For example, on a Digital Equipment Corp. VAX 780, the price is $75,000, which includes installation of the user's proprietary model.

Simon Software Inc., 4010 Moorpark Ave., Suite 215, San Jose, Calif. 95117. Phone (408) 985-7363 [Circle 367]

Interfacing software helps Unix users

Three programs consolidated into a full-screen user interface called SoftShell ease the new user into Unix or help systems administrators manage the Unix environment. The first of the three, Yelp, provides structured help information and templates for Unix commands. The second, LSLS, classifies file types and lets users annotate directories. LShell, a full-screen scroll handler, lets the user review a terminal session while he edits and reexecutes commands as desired.

Systems integrators can customize SoftShell by writing an outline of the application. Yelp then draws on the outline to walk the user through the application. LSLS can also be customized by adding file types and appropriate operations and help for these files.

Licenses for binary-coded copies of SoftShell range from $295 to $995, depending on the CPU. Agreements with original-equipment manufacturers and distributors are available now.

Logical Software Inc., 17 Mount Auburn St., Cambridge, Mass. 02138. Phone (617) 864-0137 [Circle 369]

Software performs, displays Fourier transforms

One- and two-dimensional Fourier transforms are performed on the IBM Corp. Personal Computer, PC/XT, PC AT, and compatibles by Fourier Perspective, which handles real or complex data sets—up to 8,192 points. The transform file is automatically saved on disk.

Two-dimensional arrays of up to 128 by 128 complex points can be transformed, and with the optional 8087 math coprocessor, a 32-by-32 two-dimensional transform is performed in 14 s. A hidden-line plot removes concealed segments, or files can be displayed with a non-hidden-line fast plot.

Fourier Perspective requires PC-DOS release 2.0 or later, 192-K bytes of memory, and two disk drives, plus an IBM color card or Hercules graphics card. Grafplus, an optional screen-dump utility, prints out the results on a number of dot-matrix printers. The price of Fourier Perspective is $89 and Grafplus is $40.

Alligator Transforms, P.O. Box 271505, Houston, Texas 77277. Phone (713) 665-3855 [Circle 368]

Eight Winchester drives dwell in single cabinet

A total of 1.3 gigabytes on eight 168-megabyte Winchester drives is packaged in the 4120-V8, a single cabinet that occupies 6 ft^2 of floor space. I/O requests do not

have to be queued because the multiple drives allow concurrent access to eight disks. Thus up to eight users can use the same file simultaneously, with an average seek time of 20 ms.

"Disk mirroring" means that the operating system can store duplicate data on an independent disk drive, ensuring that the data can be accessed even if one drive should fail. Because information is duplicated on mirrored pairs, the user can perform read operations on both mirrored disks at the same time, which speeds reads to disk and keeps queuing to a minimum.

The V8 uses a dedicated power supply for each disk drive and two cabinet power cords, each supplying power to four drives. The minimum configuration of the cabinet and four drives is priced at $50,000. Additional sealed Winchester disk-drive modules can be added in increments of two, at $20,000 per pair, up to a maximum of eight modules per cabinet. The maximum configuration of a V8 system, eight drives and cabinet, costs $88,000. Systems are available now.

Tandem Computers Inc., 19333 Vallco Pkwy., Cupertino, Calif. 95014. Phone (408) 725-6000 [Circle 370]

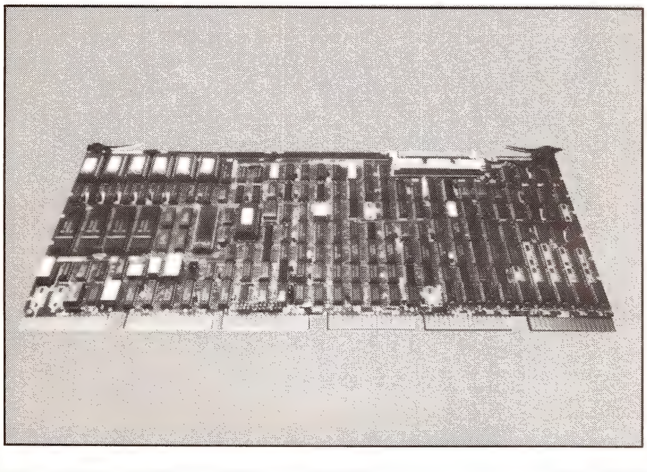
Cache buffer emulates streaming-tape drive

Emulating the Digital Equipment Corp. TS11 tape subsystem, the Tape Dimension IV CacheCoupler contains 64-K bytes of storage. This ability to store multiple records ensures that streaming-tape devices operate efficiently on DEC PDP-11 computers with no "data late" tie-ups on heavily populated buses.

The TD-IV installs directly into any Unibus SPC card slot in the computer or expansion chassis. Cables are available for the STC, Telex, or Pertec standard interfaces. The coupler handles formatted streaming tape drives at densities of 1,600, 3,200, or 6,250 bits/in. and operating at speeds up to 125 in./s; it also supports start/stop tape drives at densities up to 6,250 bits/in. and tape speeds of 200 in./s.

Available from stock, the TD-IV CacheCoupler carries a $1,983 price tag.

Western Peripherals, 14511 New Myford Rd., Tustin, Calif. 92680. Phone (714) 730-6250 [Circle 372]



Bevy of Multibus II products hit the streets at once

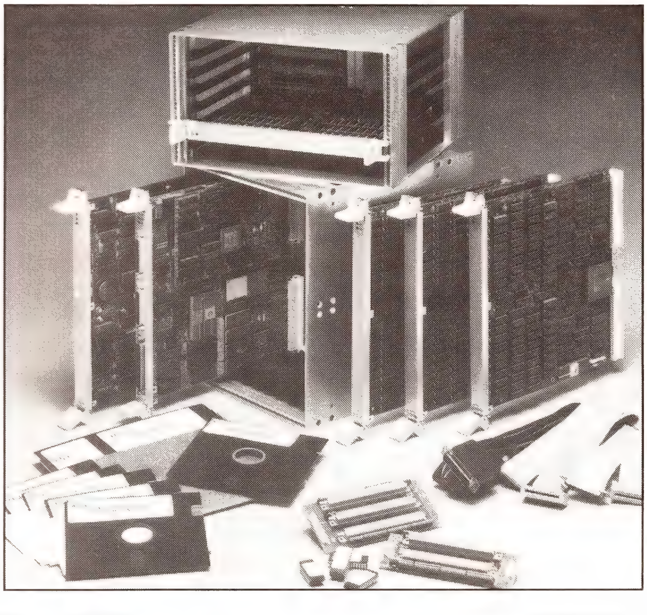
Designers now have at their disposal a full complement of Multibus II products. The 13 products currently available include the iSBC 286/100 central processor, a general-purpose single-board computer; four 32-bit cache-based memory cards; the iSBC CSM/001 central services module, which places a number of basic system-management functions on one board; a Multibus II version of Release 6 of the iRMX 86 real-time operating system; the iSDM 286 Release 2 debugging monitor; card cages and backplanes designed for Multibus II boards; and a tested and assembled evaluation kit.

Multibus II is an advanced open-systems bus designed to meet the needs of systems that are moving toward distributed architecture and multiprocessing. Multibus II systems are most appropriate for real-time industrial applications such as process control and robotics, as well as for biomedical equipment and data acquisition. Other applications include computer-aided-design and -engineering work stations, graphics equipment, development systems, and computer simulation.

The iSBC 286/100 central-processor board is built around an 8-MHz 80286 microprocessor and has a socket for the 80287 math coprocessor, an iLBX II local-bus-extension interface for zero-wait-state access to RAM, an advanced direct-memory-access controller, and two programmable serial channels, among other features.

Each of the four memory boards has a full 32-bit interface, an 8-K-byte cache, dual ports, and byte-parity error detection. The MEM/312, 310, 320, and 340 each have, respectively, ½ megabyte, 1 megabyte, 2 megabytes, and 4 megabytes of memory. The 312 uses 64-K dynamic RAMs while the other memory boards employ 256-K DRAMs.

The iSBC 286/100 sells for $3,125; the four memory boards range from $2,250 to $8,095. One-time licensing fees for the iRMX 86 Multibus II support package are



$6,500 for first-time users and $2,000 for current iRMX users. The evaluation kit is also available now.

Intel Corp., Literature Dept. W-180, 3065 Bowers Ave., Santa Clara, Calif. 95051 [Circle 380]

Stepper-motor driver promises 1 A of current

Modifications made in an earlier model have brought forth the PBL 3717A, a stepper motor drive that is guaranteed to produce a 1-A current. Because the saturation voltage of the upper power transistor is reduced by 1 V (average base-to-emitter) during recirculation, power dissipation is lower than in the 3717, the manufacturer says. Soft thermal protection reduces output current gradually, so that the motor continues to rotate.

By combining signals from three logic inputs, a pair of the drivers can be operated in half-step or full-step mode and switched to low standby when the motor is idle. Or two drivers can be used to drive two-phase motors. Alone, a single driver can drive one phase of a bipolar stepper motor.

In a 14-pin plastic package, the PBL 3717A is tagged at $2.72 in quantities of 1,000 or more units. Samples will be delivered in four to eight weeks.

SGS Semiconductor Corp., 1000 E. Bell Rd., Phoenix, Ariz. 85022. Phone (602) 867-6100 [Circle 376]

Low-end PDP-11 serves four users

Developed for the low-end, multiuser systems market, the MicroPDP-11/SV supports up to four users. The system, which includes the F-11 CPU, 512-K bytes of main memory, a 10-megabyte Winchester disk drive, a 400-K-byte RX50 disk drive, and a 4-slot backplane, uses DEC's A-to-Z Integrated System software, linking word processing, graphics, spreadsheets, and customized applications in one software package.

A wide range of 2,000 application packages that can run under the Integrated System give the MicroPDP-11/SV greater versatility, the company says. One additional disk drive can be added externally and a 31-megabyte disk is available for $1,500. The system, which costs $5,995, is available now.

Digital Equipment Corp., 129 Parker St., Maynard, Mass. 01754 [Circle 349]

Inspector checks disk media in 5 s or less

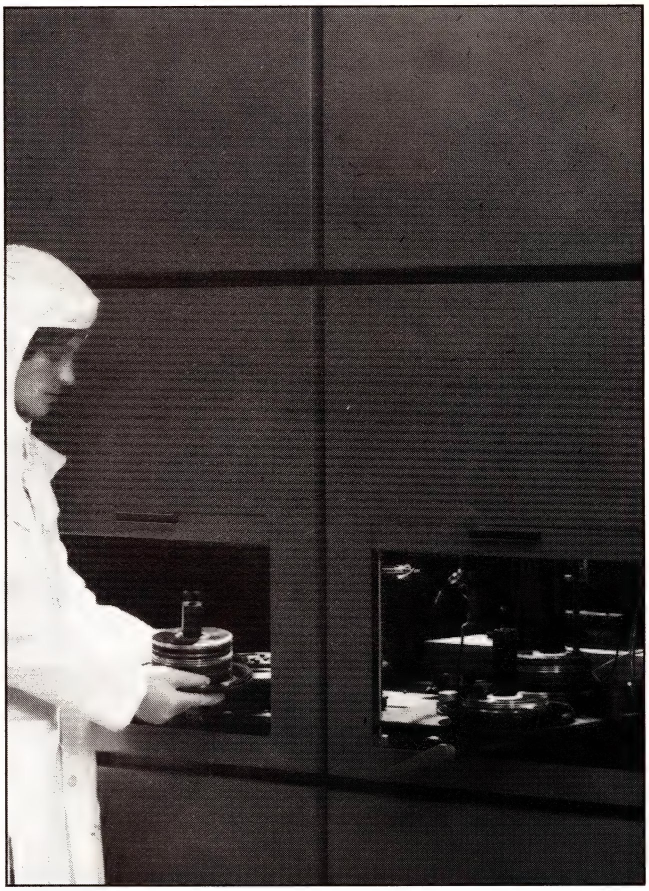
Players in the competitive game of manufacturing magnetic media may want to look closely at laser-scanning inspection equipment with the promise of reducing waste and cutting costs of making disks. Based on a technology that until now has been applied only in the labs of some media manufacturers, the scanners provide high throughput while sorting and detecting defects as small as 1 μm. In the Diskan 5000, an optical system directs the beams of two low-power helium neon lasers onto magnetic media. Detectors pick up the reflected Mie scattering patterns, and an integral IBM Corp. Personal Computer, equipped with three of GCA's boards analyzes the data and provides disk mapping. "The general scheme is well known; how to make it work is the trick," says George Quakenbos, a vice president at GCA.

The company claims that the Diskan 5000 machines, already in shipment, can completely inspect a floppy disk in less than 5 s. In production, the machines would be used to test the floppy disks after they have been burnished. The scanners can map the location, size, and two-dimensional distribution of defects on the IBM screen or printer. If found defective, disks could be discarded and could avoid both insertion into a jacket and the lengthy certification process.

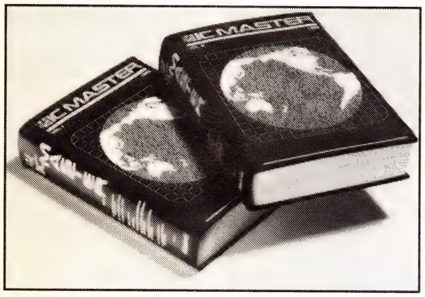
Quakenbos says that the machines could be used at several early stages in the production of hard disks—for example, during the examination of raw stock or after the substrate has been applied. Rigid disks can be scanned in 25 s.

All the machines feature automatic loading and high-efficiency particulate air filters that maintain class 100 cleanliness during inspection. Base price for the floppy-disk scanners is about $85,000. Prices for the hard-disk scanners start at about $98,000. GCA estimates that use of the scanner would add 2¢ to 3¢ to the production cost of a floppy disk, which it estimates to be 60¢.

GCA Corp., Technology Division, Burlington Rd., Bedford, Mass. 01730. Phone (617) 275-9000 [Circle 378]



New Literature



Master of the house. The 11th edition of *IC Master*, covering more than 40,000 integrated circuits from 262 manufacturers by type, function, and key parameters, has just been published in two volumes. Featured are Mil-Spec selection guides, microcomputer boards and support boards, a product index, and a part-number index. Also included are a selection guide to custom and semicustom ICs and a manufacturers' and distributors' directory. The 3,300-page set (including three updates), priced at $97.50, can be ordered from Hearst Business Communications Inc., 645 Stewart Ave., Garden City, N.Y. 11530. Phone (516) 222-2500. [Circle reader service number 430]

Trendy talk. Newsletters, market reports, and analyses covering business and design trends in Asia, Western Europe, and the U.S. are distributed by International Planning Information Inc. Sample titles and prices include: "AI Trends" newsletter (monthly), $295; *The Computer Peripherals Market in Japan*, 2 vols., $450 each; *Customizing VLSI Integrated Circuits*, $795; and *Flat Information Displays,* $100. Inquire by letter to 164 Pecora Way, Portola Valley, Calif. 94025 or call (415) 854-7306. [Circle 422]

Cell growth. Cellular radio circuits are among the new entries in Signetic's updated *Linear LSI Data and Applications Manual*, along with a single-chip FM receiver and a chip set for local-area networks. The 1,100-page volume features 262 applications and complete technical data on the company's products. Copies are free when requested on company letterhead from 811 E. Arques Ave., P.O. Box 3409, Sunnyvale, Calif. 94088. [Circle 424]

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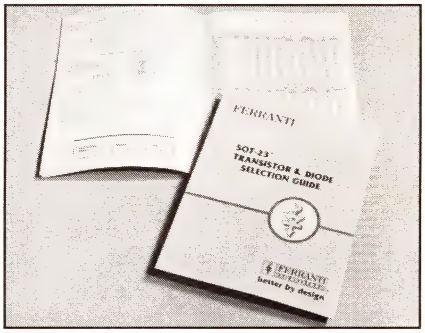
Incoming signals. Data converters, hybrid modules, synchro instruments, and data-bus products go into this 480-page applications and product catalog. Products meet MIL-STD-1772 and MIL-STD-1553 requirements. ILC Data Device Corp. distributes the catalog free; write to 105 Wilbur Place, Bohemia, N.Y. 11716 or phone (516) 567-5600. [Circle 428]

On-line info. Public-service commission proceedings affecting the telecommunications industry in 24 states are available on line through the *State Action Reporter.* To be expanded to cover all states, the information service covers cases on rates, rules, technological topics, and more. Hard-copy reports are also part of the package. For more information, write to Regulatory Information Service, 4520 East-West Hwy., Suite 800, Bethesda, Md. 20814. Phone (800) 638-8380 or (301) 654-1550. [Circle 423]

Transients turned away. Three levels of power-protection equipment are described in a free six-page brochure that lists specifications, features, and typical construction details for all three levels. The brochure comes from Hitran Power Systems, Route 31, RD5-65, Flemington, N.J. 08822; phone (201) 782-5525. [Circle 425]

Small talk. The SOT-23 package is the subject of this six-page guide to transistors and diodes packaged by this method—over 250 types for hybrid and printed-circuit-board applications, principally in the automotive and telecommunications industries. To request a copy, call Ferranti Electronic, Semiconductor Division, at (516) 543-0200 or write the company at 87 Modular Ave., Commack, N.Y. 11725. [Circle 426]



Mix 'n' match. Module purchasing for original-equipment manufacturers is detailed in a free brochure that describes four housings, five logic boards, and other modules used in terminal construction. Dimensions are shown in diagrams and specifications are listed. To receive a copy, call Falco Data Products Inc. at (408) 745-7123. The mailing address is 1286 Lawrence Station Rd., Sunnyvale, Calif. 94089. [Circle 427]

Deft designs. A 160-page publication for design engineers, *Power Device Applications*, comes from the Power Division of Marconi Electronic Devices Ltd. (MEDL). Low- and medium-power products covered include fast-recovery and avalanche diodes, thyristor and rectifier bridges, and more. For a copy, write to MEDL Power Division, Carholme Rd., Lincoln LN1 1SG, England. [Circle 429]

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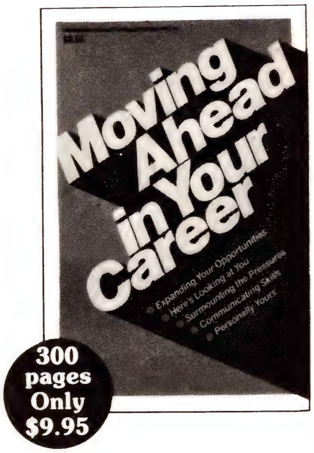
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Kasumigaseki Building 2-5, 3-chome,
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SHOOTING ONESELF IN THE FOOT

One can be excused for sometimes thinking of Washington not so much as a city of clear-minded policymakers but as a locked ward whose jolly inhabitants would rather speak to the walls than to each other.

Consider two loosely connected yet inextricably intertwined happenings centered on the nation's capital, or, to be precise, those circles of power concerned with foreign affairs. To follow, or even detect, the reasoning—forget logic—involved would require more than merely superior intelligence.

First there came the Reagan administration's budget requests. These were preceded and followed by much hue and cry, mostly over the amount of money sought for weapons [*ElectronicsWeek,* Feb. 11, 1985, p. 30] at the expense of programs perceived by many as at least equally desirable. But the aggressive Secretary of Defense warned that cutting so much as the price of a rifle would leave us virtually naked to our enemies.

Not only that, we were being told, but the President's Strategic Defense Initiative, nicknamed Star Wars and based to a considerable degree on very advanced technologies that have yet to be perfected, is vital for peace. One may disagree with those views, but one must admit that they are at least argued in sincerity and good faith.

Shortly afterward, a story appeared on page one of the *New York Times,* and in other newspapers as well, that the Soviet Union is negotiating with companies in the West for the purchase of personal computers, including Apple and IBM models, in quantities that might approach the tens of thousands. Such transactions would be legal under the terms of newly liberalized high-technology trade rules.

It also comes at a time when such systems are being sold illegally to the Soviet Union by various shady groups and individuals, albeit at prices that keep them scarce. The new orders would ostensibly go to schools so that the Soviets could attempt to catch up in computer science, a field in which they are woefully weak because of their inability to produce microcomputers.

Ask any scientist, engineer, or other knowledgeable U.S. citizen whether personal computers—even one of the relatively small and unsophisticated 4- or 8-bit models—have what it takes to run weapons systems. And we wonder if anyone at all is naive enough to believe that all those Apples, IBMs, and whatever other brands Moscow can afford to purchase will wind up being used by pink-cheeked cherubs to do their math homework.

But what really boggles the mind is that apparently no one in the administration has figured out that if the U.S. sells the putative enemy the equipment with which to escalate the technology of war, then the U.S. is going to have to escalate the technology—read, the cost—of defense in a dizzying and never-ending spiral. So if the U.S. calculates, based on today's perceived Soviet capabilities, that it will need a Star Wars plan to protect itself at the turn of the century, what will it need, and at what cost, after the Soviets have produced all those microprocessor-enhanced weapons systems and all the computer scientists to improve them?

We are not saying that is wrong to sell personal computers to Moscow. We are just wondering how it is possible that the decision to permit such sales comes from the same people who are striving to restrict the publication and dissemination of scientific papers. Or maybe the reason for the restriction is to permit sales of the end result later?

"WHEN YOU CAN MEASURE WHAT YOU ARE SPEAKING ABOUT, AND EXPRESS IT IN NUMBERS, YOU KNOW SOMETHING ABOUT IT . . . AND YOU HAVE, IN YOUR THOUGHTS, ADVANCED TO THE STAGE OF SCIENCE."

William Thomson, Lord Kelvin
British Mathematician and Physicist, 1894

Photo Courtesy of National Museums, Paris.

The Moneychanger and His Wife–
Quentin Metsys, 1514.
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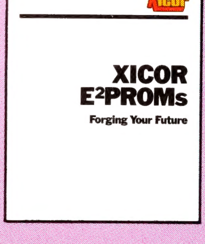
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